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OCEANIC ISLANDS: THEIR PHYSICAL AND
BIOLOGICAL RELATIONS.

Synopsis of a lecture delivered

BY

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The distinction between oceanic and continental islands was first made by Charles Darwin.

This classification, now universally accepted by scientific men, was the result of the observations and studies of Mr. Darwin on his famous voyage in the "Beagle."

Others took up and continued the work on the lines laid down by him; and a careful examination of the accounts of the early voyagers has added a great body of testimony to the soundness of the theory.

With regard to their structure, oceanic islands are volcanic, or of coral formation; and with regard to their fauna, they have no indigenous mammals and no amphibia.

The existence of these islands implies, therefore, a continuous ocean; since, if they had at any time formed part of a mainland, some representatives of the amphibia and the mammals of the continent must have kept their place on the island. The ocean has been the insuperable and

permanent barrier to the dispersion of animal forms, and there is every reason to believe that there has been no serious change in the ocean area of the globe from the very earliest days.

Mr. Darwin says on this subject ("Origin of Species," 6th ed., p. 288):

"Looking to existing oceans, which are thrice as extensive as the land, we see them studded with many islands; but hardly one truly oceanic island (with the exception of New Zealand, if this can be called a truly oceanic island) is as yet known to afford even a fragment of any Palæozoic or Secondary formation. Hence we may perhaps infer that during the Palæozoic and Secondary periods neither continents nor continental islands existed where our oceans now extend; for had they existed, Palæozoic and Secondary formations would in all probability have been accumulated from sediment derived from their wear and tear; and these would have been at least partially upheaved by the oscillations of level which must have intervened during these enormously long periods.

"If, then, we may infer any thing from these facts, we may infer that where our oceans now extend, oceans have extended from the remotest period of which we have any record; and, on the other hand, that where continents now exist, large tracts of land have existed, subjected, no doubt, to great oscillations of level, since the Cambrian period."

I have myself said in another place that the general permanence of the continental areas cannot be doubted, but they have undergone wonderful and repeated changes in detail.

Every square mile of their surface has been again and

again under water. Lakes and inland seas have been formed, and filled up with sediment, and been subsequently raised into hills and even mountains.

Arms of the sea have existed, crossing the continent in various directions and isolating the divided portions for varying intervals.

Seas have been changed into deserts and deserts into seas. Volcanoës have grown into mountains, have been degraded and sunk beneath the ocean, have been covered with sedimentary deposits, and again raised up into mountain ranges; while other mountains have been formed by the upraised coral reefs of inland seas. The mountains of one period have disappeared by denudation or subsidence, while the mountains of the succeeding period have been rising from beneath the waves. The valleys, the ravines, and the mountain peaks have been carved out and filled up again; and all the vegetable forms which clothe the earth and furnish food for the various classes of animals have been completely changed again and again. All these changes, however, have taken place within the continental areas, substantially the same as they now are.

There is nothing to show that other continents have existed in any part of what is now the ocean. The very extended and careful soundings made in the great oceans, and most of all those made but recently by the "Challenger" expedition, have proved beyond question that the waves roll everywhere over a floor surprisingly uniform and regular, and more level in many places than the most level prairie.

There is one distinction to be made here. Outside of the shore-line of the continents, there extends beneath the

surface of the waters, for distances varying between 50 and 150 miles, a sloping base or pedestal of the continental mass. The outer edge of this base, the true limit of the continent, is known as the thousand-fathom line ; and it marks the beginning of the ocean. Islands that lie within this line are continental islands. These are of ancient or of recent formation, the former being generally divided from the mainland by a greater depth of water.

Where the continent comes to an end at the thousand-fathom line, the ocean suddenly deepens to two or three miles.

The continental islands, still attached as they are to the base of the mainland, are to all intents and purposes a portion of the continent, as well in structure as in the forms of animal and vegetable life which they afford. It is in the oceanic islands that we should meet with limited and peculiar types.

The first group that we are to examine is the collection known as the Bermuda Islands. These islands, or islets, for they are very small, number about one hundred, with a total area of not more than fifty square miles. They are composed of coral and coral-sand, hardened into rock ; they are but little elevated above the ocean, and they are surrounded by reefs, some at a distance of thirty miles from the main group. Immediately beyond these reefs the ocean is very deep, soundings in four directions showing 2,500 fathoms.

Captain Nares, of the "Challenger," in his report, speaks of Bermuda as a "solitary peak rising abruptly from a base only 120 miles in diameter."

These islands may, therefore, be regarded as typically oceanic.

They are situated in 32° N. Lat., at a distance of 700 miles from the continent.*

There are in the islands no indigenous land mammals, no frogs, and no snakes; and there is but one species of lizard.

There are in all 180 species of birds known in the group; but of these only ten are resident, and one of these, the English sparrow, has been introduced by man. More than half of the whole number of species consists of waders and swimmers, and about 85 are land birds which, it might be thought, could hardly fly so far. Most of these birds are migratory, and all are American.

It is well known that North America possesses a greater number of migratory birds than any other continent, because of its variable climate and great extremes of temperature. These meteorological conditions give rise to sudden and violent storms, and these, blowing from the land, catch and carry out to sea the birds on their periodical journeys to the north and to the south. Immense numbers of these birds must perish every year, when swept out in this way on the stormy Atlantic, and those that find refuge on the little group of the Bermudas are comparatively few.

This continual accession of new individuals has kept the birds of these islands from developing any distinct variety, such as oceanic islands ought to show.

The insects of the Bermudas are but few, and they are all common North American or West Indian species.

The plants number about 300, exclusive of those European and tropical forms which have been introduced by man. Less than half of the 300 are indigenous.

* Cape Hatteras is a little less than 600 miles distant from the Bermudas, but the coast trends to the northwest and to the southwest, and Mr. Wallace's statement is substantially correct.

The majority are West Indian, and they are supposed to have been brought to the islands by the Gulf Stream. Those plants which are North American were undoubtedly introduced by the agency of birds.

Seeds are carried by birds in various ways. Very minute seeds are caught in the feathers or under the wings, and so transported; others again, as the seeds of berries and small fruits, remain undigested when the fruit is eaten, and germinate when deposited; and in many cases mud, containing the seeds of grasses and plants, clings to the feet of birds and is borne with them in their flight.

We see, therefore, that two conditions are required for the introduction of plants into an oceanic island, by means of birds.

The adjacent continent must have a number of migratory birds, and the ocean between the continent and the island must be stormy, and frequently swept by gales from the land.

The birds and the plants of Bermuda are, as we have seen, almost identical with those of the continent, for the reasons given. With the land shells the case is a little different. One fourth of those found in the islands are peculiar, the whole number being but twenty; and the explanation is that the difficulty in the way of transmission is immensely great in the case of land shells. Terrestrial mollusks reach the islands only by accident, on floating logs, on bits of timber, and sometimes, perhaps, on portions of dams or weirs, established on inland creeks or rivers and borne away to sea by freshets. A species thrown up in this way on those remote islands would remain isolated for an unknown length of time, and undergo modification in its new habitat.

The second group of islands to be considered is the Azores. These islands lie in the North Atlantic, between 37° and 39° 40' N. Lat., and stretch southeast and northwest, over a distance of 400 miles. The largest of the islands, San Miguel, is about 40 miles long, and the area of the whole group is 700 square miles. It should be noted that the Azores are almost equidistant from the three continents, Europe, Africa, and America, though they are generally classed as African islands. They are of volcanic origin and have frequently suffered from earthquakes and volcanic eruptions; and they present all the marks of volcanic islands—extinct craters, beds of lava broken into friable soil, precipitous mountains, and a dangerous coast. New islands sometimes rise within the group or very near it, and disappear again. The coasts are high and the surface is undulating, with a number of mountain peaks, of which St. Mary's, the lowest, is about 2,000 feet high, and Pico, the highest, not far from 8,000.

The nearest mainland is that of Portugal, to which country the islands belong, and the distance is a little under 900 miles. The ocean lying between is 2,500 fathoms deep. The thousand-fathom line encloses the whole group, but the least depth encountered within 300 miles is 1,800 fathoms. It is not to be supposed, therefore, that these islands were ever united with the European continent; and their volcanic structure makes it incredible that they could have formed part of an Atlantis which included Madeira and the Canaries, the former also volcanic, and the latter a continental group, though volcanic. In all their physical features the Azores come within the strict definition of oceanic islands. In the fauna of the group, the great feature of oceanic islands—

the absence of all indigenous land mammalia and amphibia—is well shown; and there are, furthermore, neither snakes, nor lizards, nor frogs, nor fresh-water fishes. It is true that rats and mice, rabbits and weasels, and a small lizard, which belongs to Madeira and Teneriffe, are now found wild in the Azores, but there is every reason to believe that all these have been introduced by man. The goldfish and eels now found in some of the lakes have the same origin.

Flying creatures, birds and insects, are abundant; and there is also a small European bat.

There are fifty-three species of birds in the Azores; but of these thirty-one are swimmers or waders, birds whose powers of flight are so great that their presence in any island, however remote, is not remarkable. All these aquatic birds are of common European species, and twenty of them are resident in the islands, while eleven are stragglers.

Of the twenty-two land birds, only four are stragglers, the other eighteen being permanent residents. All of these are common in Europe and in North Africa, excepting three, the Atlantic chaffinch and the canary, which inhabit Madeira and the Canaries, and the Azorean bullfinch, which is peculiar to the Azores.

How did these continental birds reach the islands? Mr. Fred. Du Cane Godman, in his "Natural History of the Azores," tells us that, "Hardly a storm occurs in spring or autumn without bringing one or more species foreign to the islands; and I have frequently been told that swallows, larks, grebes, and other species not referred to here are not uncommonly seen at those seasons of the year."

Here again, therefore, we find one of the conditions for the stocking of oceanic islands with animal life, working even at the great disadvantage of 200 additional miles of distance to be overcome. That it works much less effectively in the Azores than in Bermuda is shown by the very much smaller number of species of birds in the former group, 53, as against 180 in the latter. The ratio between these figures would be greatly reduced if the relative areas of the groups were taken into the account, and it is evident that the additional 200 miles of distance act as a very severe means of natural selection, since only exceptionally vigorous birds could survive the buffeting of Atlantic storms for 900 miles. New species may, of course, be added to those already existing; and Mr. Godman has found the wheat-ear breeding in the old crater of the island of Corvo. This is probably a recent immigrant establishing itself.

The birds of the group are most abundant in the islands nearest to Europe and Africa, and this is almost conclusive evidence that they arrived as stragglers. There are three groups in the islands, an eastern one of two islands, a central one of five, and a western one of two. The species diminish in number from the east to the west.

The peculiar bullfinch of the Azores is undoubtedly the result of climatic and other conditions operating through a long period of time. This bird does not migrate and, as it inhabits woody districts, is less likely to be blown out to sea.

The insects, excepting the beetles, are few in number and nearly all of European species. The beetles number 212, and 175 of these are European; but only 74 are

really indigenous, the others having been brought in by man. Twenty-three of the indigenous species are not found in any other of the Atlantic islands and must have been introduced directly from Europe. Only fourteen out of the whole number are peculiar to the Azores. The chances of the same species of insects arriving in the islands are very few, and this fact tends to develop and establish peculiarities; and we find accordingly that while the birds are proportionately more numerous than the beetles, there are very many more peculiar species of the latter.

Among the land shells the number of peculiar species is yet greater than among the insects; and this was to be expected, for the introduction of a mollusk is a rare event, owing to the difficulties in the way of transmission, and a distinct type would soon be developed under the new conditions.

Out of sixty-nine species, thirty-seven are common to Europe, or to the Atlantic islands, and thirty-two are peculiar to the Azores.

The flora of these islands presents 480 species of flowering plants and ferns, and of these 440 are also found in Europe, Madeira, or the Canary Islands, while 40 are peculiar to the Azores. The agencies already named are sufficient to account for the presence of the European and other exotic plants; and it is significant that most of the trees and shrubs with large and heavy fruits are wanting in the Azores. There are no oaks, chestnuts, hazels, apples, beeches, alders, or firs; and the laurestinus, myrtle, Portugal laurel, elder, and other trees or large shrubs found in the islands bear berries, and might, therefore, have been introduced by birds

in one of the ways described. Of the forty species supposed to be peculiar, all but six, which have affinities in the Canaries or Madeira, are allied to European plants.

The almost wholly European character of the Azorean animals and plants leads to the conclusion that what may be called extraordinary and exceptional causes are more potent in the transfer and introduction of forms than the ordinary and more regular causes. The Azores lie in the track of the return southwesterly trade winds and also of the Gulf Stream, and it might be expected that these forces, working steadily in one direction, would fill the islands with American animals and plants, and prevent the introduction of European species. It is the action of the violent storms to which the Azores are subject that has disappointed this expectation, and impressed the European stamp on their fauna and flora.

The Galápagos Islands, the third group we shall examine, differ in important respects from the Azores and the Bermudas. In these we find but a small number of peculiar animals and plants, and we have to note the constant arrival in the Bermudas and, in a lesser degree, in the Azores, of migratory birds and even of insects and plants, brought by the recurring storms of the Atlantic. In the Galápagos the sea and the air are equally undisturbed.

* These islands, discovered by the Spaniards in the 16th century and named from the numerous *galápagos*, or giant tortoises, which inhabit them, are still not very well known. The group consists of five large and ten small

* They were called also the Enchanted Isles—*Islas Encantadas*—because of the strong current and the calms, which made it difficult for ships to approach or to leave them. The Spaniards named also the larger islands, Mascarón, Diabolo, Santiago, and others, but the English names have prevailed.

islands, and the total area is estimated at 2,250 square miles.

In the large islands, Albemarle, Chatham, Narborough, Indefatigable, and James, there are mountains of from 3,000 to 4,000 feet in height.

When discovered the Galápagos were uninhabited, and they have remained so to this day, with the exception of two or three penal settlements, kept up by the government of Ecuador. The largest of these settlements, that named La Floreana, on Charles Island, contained at one time 200 or 300 inhabitants, but when the U. S. Steamer "Hassler" visited the group in 1871, there were only about a dozen. Cattle, swine, and goats have been introduced and now run wild.

The Galápagos lie in the Pacific Ocean exactly under the equator, at a distance of about 600 miles from the South American coast; and they are occasionally visited by traders from Guayaquil who collect the *orchilla* for market.

The climate is tempered by the cold Antarctic currents which turn northwest from Cape Blanco on the Peruvian coast and pass through the islands. There is very little rain except from November to January. There is a good deal of low cloud and the nights are misty, but it is only on the higher land, from 800 to 1,000 feet above the sea, that there is any luxuriant vegetation. The low lands are rocky and parched, with a bare growth of stunted shrubs and Peruvian cactus.

The whole group is volcanic, and stands upon a deeply submerged bank, the thousand-fathom line encircling all the more important islands at a few miles' distance, whence there seems to be a steep descent all round to the

average depth of that portion of the Pacific, between 2,000 and 3,000 fathoms.

As in all other oceanic islands, so here we find no truly indigenous mammals; and frogs and toads, the only tropical representatives of the Amphibia, are equally unknown.

Reptiles are, however, represented by the land tortoises, lizards, and snakes. The tortoises are of two peculiar species, one found on most of the islands, and the other but recently discovered on Abingdon Island, from which it has been named. There is also one extinct species. These are all of very large size, and it is thought that they may have been originally derived from the American continent. It does not seem extravagant to suppose, considering the tenacity of life of these animals, that some ancestral form, carried out to sea by a flood, may have been drifted to these islands.

The lizards are five in number—a peculiar species of Gecko, and four species of the American family Iguanidæ. One of these is aquatic and is found in all the islands, swimming at some distance from the shore and feeding on sea-weed.

It is evident that these lizards were derived from the American continent, and at some remote epoch; but how they reached the islands it is impossible to say, though we know that animals of this kind have some means of crossing the sea, since they are found in a considerable number of islands which possess no mammals, nor any other land reptiles.

There are two species of snakes, and this fact is remarkable, because serpents are very rarely found in oceanic islands. Both these snakes are closely allied

to South American varieties, and one is almost identical with a Chilian snake. This fact seems to show that their presence in these islands dates from a comparatively recent period; and it may be accounted for without straining the probabilities. Snakes survive a long time at sea, and an instance is on record of a boa-constrictor that once reached the island of St. Vincent from the coast of South America, a distance of two hundred miles by the shortest route. Snakes are very often found in trees, and might easily be carried long distances if floated out to sea on a tree swept down by a tropical flood or uprooted by an earthquake.

Of birds there are in all fifty-seven species, and of these thirty-eight are peculiar to the Galápagos. Eighteen of the others belong to the aquatic tribes, which are pre-eminently wanderers. The true land birds are thirty-one in number, and all but one are entirely confined to these islands; while more than half of them present such peculiarities that they are classed as distinct genera. They are all allied, and some of them very closely, to birds inhabiting tropical America; while one, the common American rice-bird, is the only land bird identical with those of the mainland. A classification of the birds shows that the diversity between the island and the continental types is greater in proportion to the difficulties and the obstacles in the way of migration. The rice-bird is the only completely unchanged species of land bird in the Galápagos. This bird, which breeds in Canada, swarms over the whole United States, migrates to the West Indies and to South America, visits the Bermudas, distant as they are, almost every year, and ranges as far as Paraguay; and we may conclude that it reaches

the Galápagos often enough and in sufficient numbers to keep up the purity of the breed. The short-eared owl is found here, as it is on the mainland and the continental islands of the Old and the New Worlds.

The more distinct species are allied to non-migratory species peculiar to tropical America; while the distinct genera are allied to South American finches and sugar-birds, which have but a restricted range. The remote ancestral forms of these which reached the Galápagos have remained, therefore, uninfluenced by later migrations and have been developed into a number of distinct types.

The insects of the islands are very few; the beetles, the most plentiful of all, furnishing only thirty-five species, belonging to twenty-nine genera and eighteen families. They are almost all peculiar.

There are about twenty land shells, most of them peculiar species. The currents bring to the southeastern shores of the islands canes, bamboos, drift-wood, nuts of the palm, and other floating objects, and in this way some, at least, of these insects and land shells have been introduced. Besides the waves and the winds, which bring leaves with small insects and eggs of mollusks, there must have been, in islands like these, still subject to volcanic action, an elevation of intervening islands between the coast and the present group, to facilitate the passage of organisms.

The plants of the Galápagos are much more numerous than the known animals, including the insects. There are, in all, 332 flowering plants, 174 of which are peculiar, while 158 are common to other countries. Twenty of these are known to have been introduced by

man. Of the plants which may be called American, 42 are found in North and South America, 21 in South America alone, and 20 in North America and the West Indies.

Sir Joseph Hooker has observed that the plants peculiar to the Galápagos are allied to the plants of temperate America or to those of the high Andes, while the non-peculiar species are such as inhabit the hotter regions of the tropics near the level of the sea. The seeds of this class of plants possess special vitality, and are known to stand long voyages, or they have special means of transport.

One characteristic, and a very significant one, marks the vegetation of these islands. All the plants, without exception, are pale in tone and lack color and beauty; and the flowers are feeble and of a greenish hue. The importance of insects, in the development and vitalization of plants, is nowhere more decidedly shown; for it is impossible not to associate the weakness of the vegetable creation with the scarcity of insects in this group.

In order to arrive at some intelligible theory of the peculiar fauna and flora of these islands, it is necessary to take into account the long-past conditions of sea and land and past changes of climate. The affinities of so many of the plants and of some of the birds in the Galápagos with those of a north temperate and high mountain region point to great changes of climate in the northern hemisphere.

We have seen that in the Bermudas and the Azores the birds are almost exclusively continental and migratory, and that their presence is due to the frequent storms from the direction of the continent; and it is not

difficult to understand why the Galápagos should be far richer in peculiar forms, both of animal and vegetable life, than either of the Atlantic groups considered.

NOTE. *The following communication, made by Mr. D. Morris, of Kew, to NATURE, of Dec. 16, 1886, possesses great value as bearing directly on the main argument of Mr. Wallace's lecture:*

The part taken by birds in the dispersion of plants is one of great interest in view of the difficulty of accounting for the appearance of certain species in remote islands, no less than in localities nearer to each other, or divided by such barriers as mountain ranges or deep seas. This subject has, more or less, engaged the attention of botanical travellers from the time when Darwin published his classical "Journal of Researches," nearly fifty years ago, down to the publication of Mr. Hemsley's "Botany of the *Challenger* Expedition," part 1, which was issued as lately as last year. In the careful summary of plants probably distributed by birds, *loc. cit.*, pp. 44-49, it is mentioned that seeds may be carried by birds in either of two ways: First, by seeds, especially those provided with barbs and hooks, attaching themselves to the feathers of birds, and in the case of aquatic or burrowing birds being embedded in mud and thus carried accidentally outside; or, secondly, by seeds swallowed by frugivorous birds being for a time lodged within, and dejected afterwards in such a state as to be capable of germination. My object now is not to treat generally of this subject, but to place on record two remarkable and striking instances where seeds carried and

dispersed by birds have come immediately under my own observation. The examples which I shall here describe will, I believe, show clearly that birds are capable of acting as very effective agents in the dispersal of plants, and that the results are so apparent as to be placed beyond reasonable doubt. In cases where seeds of a light character are provided with barbs or hooks, they are well adapted for attaching themselves to passing objects, and are most favorably placed for dispersal by means of birds. The particular plant with barbed seeds which I described under this category has not, I believe, been mentioned before; but it is deserving of notice, as it fully meets all the requirements incidental to this form of dispersal, and, moreover, I have had, for some years, very favorable opportunities of observing its behavior. This plant is *Uncinia jamaicensis*, Pers. (*Cyperaceæ*), which grows in damp places in the mountains of Jamaica, at elevations of 5,000 to 6,000 feet. It is generally found overhanging small pools of stagnant water or on banks of mountain rivulets. Its slender tapering spikes, when ripe, literally bristle with long exserted rachilla, each shaped something like a shepherd's crook (hamate), but with the hooked part so closely fitting and elastic that, if drawn along the back of the hand, it would grasp and draw out the finest hairs.

Now, such places as are affected by this *Uncinia* are also the frequent resort of numerous birds that come there to drink, or bathe, or to seek coolness and shade. In the case of migratory birds, and especially those that cover long distances in their flight, the high lands are generally those first touched. This is doubtless owing to the elevation at which they fly to escape surface currents

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or local objects. I have often noticed birds from the North (the United States) on their way South, and again birds from the South returning to the North in early spring, frequenting the highlands of Jamaica, and resting there for a time before continuing their journey. Some such birds have been easily caught by hand, so exhausted were they with their long flight. In two instances I have found small migratory birds so completely entangled in the hooks of the *Uncinia* (*Gardeners' Chronicle*, 1881, p. 780) that they were unable to extricate themselves; and, unless set at liberty at the time, would probably have died in that situation. In these instances the hooks of the *Uncinia* overstepped their proper function; for, obviously, no benefit would arise to the plant from the death of the birds, but only in the removal of the seed to another place. Larger birds, of course, would not be caught; but on the other hand, if they came within reach of the *Uncinia*, they could hardly get away without detaching a large number of the fruits and transporting them wherever they went. In the case of the *Uncinia*, there is present nearly every condition necessary to secure a very complete dispersion of its fruits. The plant, in the first place, is possessed of light portable seeds easily carried about from one locality to another; in the second place, the seeds are provided with highly specialized hooks which effectually grasp any thing that comes within their reach; and lastly, the plant affects just those places which are visited by birds, and seldom fails to secure a sure and trusty carrier. It follows, as a matter of course, that *Uncinia jamaicensis* is found plentifully distributed in the track of migratory birds, and is found in similar situations in the mountains

on the mainland in Central America, Venezuela, Ecuador, etc. So much for seeds with barbs and hooks.

We now come to the second class of seeds, namely, those which are swallowed by frugivorous birds, and dejected in a state suitable for germination. The most striking examples I know of the dispersion of such seeds, and of the results which immediately follow, are shown in connection with the pimento industry of Jamaica, which, as shown below, depends entirely for its existence on the offices of frugivorous birds. The pimento of commerce is the dried fruit of the pimento allspice, or Jamaica pepper tree (*Pimenta vulgaris*). No other country supplies this article, although the tree itself is widely distributed both in the West Indies and on the mainland, and the value of the exports of pimento from Jamaica has reached (in 1880) a total of £100,000. This is probably the largest spice industry in the world, and to repeat what is mentioned above, it is wholly dependent upon the action of frugivorous birds. In Lunan's "Hortus Jamaicensis," vol. ii., p. 67, published about the end of last century, it is stated that "the usual method in forming a new pimento plantation or 'pimento walk' is nothing more than to appropriate a piece of woodland in the neighborhood of a plantation already existing; or in a country where the scattered trees are found in a native state, the woods of which being fallen, the trees are suffered to remain on the ground till they become rotten and perish. In the course of twelve months after the first season's rains, abundance of young pimento plants will be found growing vigorously in all parts of the land, being without doubt produced from ripe berries scattered there from the birds, while the fallen trees, etc.,

afford them both shelter and shade." In a foot-note it is added that "birds eagerly devour the ripe seeds of the pimento, and, muting them, propagate these trees in all parts of the woods. It is thought that the seeds passing through them undergo some fermentation which fits them better for vegetation than those gathered immediately from the tree." The present plan for forming pimento plantations in Jamaica is exactly as described above. In fact, the planters firmly believe that no other plan is likely to produce good pimento walks, although it has been shown by experiments in the Botanical Gardens that by careful treatment plants of pimento can be raised in nurseries in large numbers, exactly as any other economic plants. It remains, however, that all the present pimento plantations in Jamaica have been formed by the action of frugivorous birds, and to this agency alone we are indebted for the commercial supply of a most valuable and wholesome spice.

NEW MEXICO : ITS GEOGRAPHY, SCENES, AND PEOPLES.

BY

CLARENCE PULLEN.

After Hernan Cortes and his victorious forces had conquered the nations of what is now the Mexican republic, and had overthrown the dynasty of the Montezumas, they established their capital on the ruins of the great Aztec pueblo of Tenochtitlan. They named the new city Mexico, after *Mexitli*, the Mexican god of war, and the name in time was applied to the entire subjugated country, which was also known as New Spain. But there remained unexplored in the north a vast region through which flowed two great rivers to the southeast and the southwest, their waters pouring respectively into the Atlantic Ocean and the South Sea. The first of these rivers was the Rio Grande, the other was the Rio Colorado. Marvellous stories were told by the southern natives of populous cities and inestimable treasures in this northern land, from which had originally proceeded the ancestors of the races found by the Spaniards in Mexico. In the year 1540, nineteen years after the fall of the Aztec confederacy, and during the lifetime of Cortes, a military expedition was organized in Mexico under the command of Francisco Vasquez Coronado, the governor of the province of New Galicia, to explore and conquer this fascinating mysterious region. As Coronado

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marched north, he found cities of peoples resembling the Aztecs in many respects, who cultivated the soil, and whose garments were made of finely tanned skins and of cotton. They wore pieces of turquoise as ornaments, but except these possessed no treasure. The aspect of the country was much like that of Northern Mexico, and hence the region was christened New Mexico. Coronado took possession of the Indian city that stood on the site of the present town of Santa Fé, the capital of New Mexico, and thence, attracted by the stories told him of a great and rich city called Quivira, marched east in search of it across the plains, through Kansas to the Missouri valley. He returned unsuccessful to Santa Fé, taking the same route followed three centuries later by the trading caravans that for fifty years carried merchandise from the Missouri River to New Mexico over the famous Santa Fé trail. In 1543, Coronado returned with his forces to Mexico, bearing accounts of the region he had explored, and, thenceforth, New Mexico had a name and existence in the geography of the Spanish possessions in America. The first permanent colonization of this country was made in 1591 by an expedition from Zacatecas, Mexico, headed by Juan de Oñate, who, with a force of soldiers, and one hundred and thirty families for colonization, proceeded up the valley of the Rio Grande to the point of junction with the river Chama, and there founded the first white settlements in New Mexico, which, thereafter, held the rank of an ultramarine province of the Spanish Crown. With the exception of twelve years following the Pueblo Indian uprising in 1680, New Mexico was held continuously as a province under Spanish viceregal government for a period of two hundred and

thirty years. On the liberation of Mexico from the yoke of Spain in 1821, New Mexico became a state of the Mexican republic. It was ceded to the United States in 1848, after the war with Mexico, and was organized as a territory under the American government in 1850.

The boundaries of New Mexico have varied greatly in the different epochs of her history. Up to the end of the seventeenth century, except on the south she had no stated boundaries, but extended indefinitely on the north and east and west over an unexplored country. After France had asserted its claim to the great territory then known as Louisiana, the Arkansas River was recognized as a common boundary between the French and the Spanish possessions, and its head-waters in the Rocky Mountains consequently became the northerly limit of New Mexico. When Louisiana became, in the beginning of the present century, for a short time a possession of Spain, the boundary of New Mexico may be said to have extended on the north to British America, but it returned to its former limit on the recovery of Louisiana by France. The formation of the Mexican States of California and Texas gave boundaries to New Mexico on the west and east, and defined its limits with enough precision for rough mapping. An old map of the eighteenth century, which forms part of the archives in the national library in Mexico, shows New Mexico as extending substantially over the territory now occupied by New Mexico and Arizona. The province is represented as divided into *alcalderias*, or districts, each subject to the authority of its *alcalde*, or local magistrate. These districts, in some cases, correspond with the present location of New Mexican counties, and bear the same names.

To show the uncertainty of geographical knowledge concerning New Mexico in the beginning of the present century, even among the best informed, there may be instanced the statement of Alexander von Humboldt, who, writing in 1804, describes it as a country 175 leagues in length from north to south, and from 30 to 50 leagues in width, the Spanish league being approximately two and six tenths English miles. He had evidently in mind the Rio Grande valley, which, with the nearest parts of its tributary valleys, contained almost the entire civilized population of New Spain north of Chihuahua.

On the other hand, the *General Gazetteer*, 1811, by Wm. Lochhead, Berwick, England, says, in a description of this province: "Mexico, New, or New Granada, a large country of North America, bounded on the west by the Gulf of California, on the south by New Spain, on the east by Florida, and on the north by an unknown country; lying between 79° and 108° west longitude, and 23° and 43° north latitude, and being about 2,000 miles long and 1,600 broad. The principal Spanish colonies are those of St. Barbe, and Santa Fé, the capital town."

Generally speaking, no two geographical works written prior to its annexation to the United States agree in their descriptions of New Mexico.

After the cession of New Mexico to the United States in 1848, its eastern boundary was fixed at the 103° meridian, Greenwich. The formation of the territories of Colorado and Utah took part of its northern area, and, in 1863, Arizona was erected from part of its western domain. Its southern boundary from the Rio Grande to the Rio Colorado had been determined by the Gadsden purchase in 1853, which added to New Mexico a disputed strip lying between these two rivers.

The New Mexico of the present day lies between the parallels of latitude $31^{\circ} 20'$ and 37° north, and between the meridians 103° and 109° west, Greenwich. Its general dimensions may be stated as 366 miles from north to south, and 335 from east to west. Its area, according to the census report in 1880, is 122,580 square miles, an extent exceeding that of New England, New York, and New Jersey combined. Its southern half lies in about the same latitude as Mississippi, Alabama, and Georgia, and the territory lies generally in the same latitude as Syria and Central Persia. The population of New Mexico, by the census taken in 1885, was 131,985, which includes 9,200 Pueblo Indians, but is exclusive of 1,790 Apache and 17,200 Navajo Indians, the reservation of the last-named occupying, about equally, portions of New Mexico and Arizona.

New Mexico is a land of high plateaus and mountains. Its lowest point, the foot of the Mesilla valley, where the Rio Grande crosses its southern boundary, is about 3,500 feet above the sea; its highest point, the summit of Mount Baldy, near Santa Fé, is 12,202 feet in altitude. About 100 miles west of meridian 103° , which is the east boundary, the foot-hills of the Rocky Mountains, here known as the Sierra Madre, begin. From their base, which lies at an average altitude of 6,000 feet, level plains stretch toward the east, breaking abruptly one down to the other like steps until the low levels of Texas are reached. These plains are covered with the short curly grama grass, and, in most localities, are sufficiently intersected by streams to afford the necessary water for all purposes of grazing. As a country for the raising of cattle and sheep, the eastern plains of New Mexico are

not surpassed by any region within the arid grazing area of the United States. In Southeastern New Mexico rise two detached mountain ranges known as the Guadalupe and the Sacramento mountains.

The configuration of New Mexico in the western two thirds of its area is about equally mountain and plain. The Rocky Mountains push through the State of Colorado like a crest surmounting the great upward slope from the Mississippi valley west; in New Mexico they separate into parallel ranges running north and south, between which lie high level plains. The same conditions prevail in the northern Mexican states, so that even in the earliest times a carriage could be driven from the city of Chihuahua to Santa Fé, New Mexico. In the old days the *ricos*, or rich people, used to make the journey in heavy carriages, a sort of calash, which were called *volantes*. These high plains are usually covered with a growth of grama grass, scattering, but which affords excellent grazing, and in lower altitudes, in Southern New Mexico, they are dotted with clumps of the short bushy mesquite tree. The varieties of cactus and yucca-plants which in Northern New Mexico are comparatively small in growth, increase in size and numbers toward the south, and new species appear. The mountains, which are precipitous, present an aspect of partially exposed volcanic, granitic, or sandstone rock, and are usually wooded with pine and cedar from their base some distance up their sides, particularly in the ravines. The foot-hills are commonly sprinkled with a growth of the piñon or dwarf pine characteristic of the country, the cones of which afford a small nut greatly esteemed as food by the inhabitants. In the northern mountainous region are pine

forests of considerable extent, which supply the bulk of the lumber used in construction in New Mexico.

New Mexico has sufficient diversity of elevation to comprehend the four zones of vegetation into which the "Regions of the Southwest" are divided, according to altitude, in the report of the Wheeler Exploring Expedition. This classification is as follows: (1) Zone of cactus, yucca, and agave (mescal plant); altitude 3,000 to 3,500 feet; grass is scanty; where there is water a most luxuriant vegetation springs up. (2) Zone of obione and artemisia (grease-wood and sage-brush); altitude 3,500 to 4,900 feet; grass is poor, with few exceptions, on granitic and volcanic soil. The cactus species are diminished in number. (3) Zone of *Juniperus occidentalis* (cedar; altitude 4,900 to 6,800; cactus species few. (4) Zone of pine and fir, 6,800 to 10,800 (highest points). Above 8,000 feet nightly dews fall.

Among the mountain summits in New Mexico; especially in the north, are valleys, often of considerable extent, lying at elevations of 8,000 to 10,000 feet altitude, which in summer are watered by frequent rains, and on which the snows remain all winter. Here may be found luxuriant grass and a profusion of plants and flowers common in the low altitudes of the Eastern and Middle states. Poplars and sometimes elms and maples appear in the forest growth of such localities. At such altitudes only the hardier grains and vegetables can be successfully cultivated, but they flourish without irrigation.

Rising in the mountains of the San Juan country in Colorado, the Rio Grande flows south through the middle of New Mexico; at the point where it leaves New Mexico it turns to the southeast on its way to the sea and be-

comes the boundary between the United States and Mexico. The New Mexicans call it the Rio Bravo del Norte (Fine River of the North), or, colloquially, the Del Norte. This remarkable river, 1,500 miles in length, measured in its windings, is unnavigable save in the tide-waters at its very mouth. The only boats ever seen on its surface are encountered at the few rude ferries for transporting men and merchandise across its current at high water. The volume of its waters is great, but they flow mainly below the river bed, percolating the sands of its wide valley. Water may always be found in the Rio Grande valley by digging wells to the depth of the river's surface. Beginning in the Colorado mountains, a clear, sparkling stream, the Rio Grande soon becomes turbid with sand. In Southern New Mexico, below the town of Albuquerque, it flows through a region of soft alkaline earth; here, also, it is joined by the thick current of the Rio Puerco (nasty river) coming in from the west, and thereafter its waters become extremely muddy. Except in times of flood, the amount of water in sight is remarkably small for so long a river. The current is very swift, and the channel abounds in shoals and quicksands. In places the water sucks through the narrow passage between a sand bar and the shore, and again widens into a broad, rippling current but few inches deep. In very dry times the water, in places, disappears, flowing wholly through the sands beneath the channel, which is left dry and may be used as a roadway. In this connection Alexander von Humboldt records a notable instance of the disappearance of the Rio Grande from its bed. He wrote:

"The inhabitants of the Passo (El Paso) have pre-

served the recollection of a very extraordinary event which took place in 1752. The whole bed of the river became dry all of a sudden for more than thirty leagues above and twenty leagues below the Passo, and the water of the river precipitated itself into a newly formed chasm and only made its reappearance near the Presidio de San Eleazario. This loss of the Rio del Norte remained for a considerable time; the fine plains which surround the Passo, and which are intersected with small canals of irrigation, remained without water, and the inhabitants dug wells in the sand with which the bed of the river was filled. At length, after the lapse of several weeks, the water resumed its ancient course."

The floods of the Rio Grande are terrific. Whether arising from heavy rains, or the melting of snows in the mountains, they roll down, an avalanche of muddy water, overspreading the valley and sweeping all before them. They frequently force for the river a new channel, and, where the valley is wide and level, the depressions of the old watercourses can easily be traced. A few years ago, the inhabitants of the considerable town of Mesilla, in New Mexico, which stood on the west bank of the Rio Grande, woke one morning to find the river flowing on the west of their town in a new channel, which it has continued to occupy ever since. Other similar freaks of the river are matters of history both remote and recent in New Mexico.

Most of the streams of New Mexico flow into the Rio Grande. A few rising on the west of the continental "divide" empty into the Rio Colorado in Arizona, and one or two having their source on the eastern slope, in the extreme north of the territory, are tributaries of the

Arkansas River. They have the common characteristic of beginning in the mountains, cold, clear, trout streams, which become warm and alkaline, and usually diminish in size, as they flow out on the plain.

The combination of a high altitude with a southerly latitude gives New Mexico a most genial climate. The air is rare, marvellously clear, and full of ozone and electricity. At an altitude of 6,000 feet and upwards, the summer weather is never oppressive, and in the lower elevations one may be comfortable on the hottest day, if screened from the sun. The nights are always cool, as the air seems too thin to retain the heats of the daytime. The winter climate in the lower elevations is mild and sunny. At an altitude of from 6,000 to 7,000 feet there is a period of five or six weeks in December and January when the sky is frequently overcast, the weather cold, and there are occasional snow-storms. Ice forms thick on the mountain streams, and wherever snow has fallen in places sheltered from the sun, it remains unmelted during the entire winter. Generally the average fall of snow and rain increases with the altitude. Except in the mountain elevations, wherever the sun's rays fall snow and ice soon disappear from the earth's surface. The rainy season in New Mexico begins at the first of July and lasts until near the tenth of September. The rains come in the form of heavy showers with lightning and thunder, and sometimes hail, usually in the afternoon and at night. Cloud-bursts, or water-spouts, occur at this season, caused by the meeting of two clouds surcharged with rain, which is precipitated to the earth as a sheet or volume of water, which instantaneously floods the streams, and sometimes finds for itself a channel and in-

undates the plain in unexpected places. Except in the rainy season, and, in the higher elevations, the short stormy period in the winter, the weather of New Mexico is almost unintermittedly fine. Bright days of sunshine and clear nights of starlight and moonlight follow each other in delightful succession. The climate is naturally most salubrious, and, save in the lower river valleys, malaria is unknown.

The early inhabitants of New Mexico, as found at the time of the advent of the conquering Spaniards, were the Pueblo or the settled Indians, and the wild tribes, the Comanches, Apaches, and Navajos. Of the first named, the Spaniards, in the sixteenth century, found eighty pueblos (towns) in the region now comprised by New Mexico and Arizona. The Spaniards classified them in four groups, by reason mainly of difference of language. These were the Piros, Teguas, Queres, and Taños. In the twenty-five pueblos now in existence within the above-named area (twenty in New Mexico and five in Arizona), five entirely distinct languages are in use. All the Pueblo tribes have marked similarity in personal appearance, customs, and in the construction of their houses. The Pueblo has features less pronouncedly of the Indian type than those of the wild tribes, and, in the case of the Zuñis and Piros, is much lighter in complexion. He is dressed in a tunic fastened about the waist by a belt, drawers, and leggings fastened at the top, below the knee, with a scarlet garter. He wears moccasins, and his thick hair, which is invariably "banged" in front, is wound behind with a red band into a queue, or flows back over or beneath a strip of red cloth bound about the head. The dress of the Pueblo woman

generally resembles that of the man, save that her tunic is longer, she has no queue, and she wears a peculiar legging of buckskin, which gives her the appearance of having her lower limbs encased in stuffed cylinders. The Pueblo Indians dwell in quaint cities, each of which is in reality one great house, with stories made to rise terrace-like, one above the other, to the height even of eight tiers. These community houses, built of adobe (sun-dried brick), or masonry of thin, flat stones laid in mud mortar, are of the same fashion and, in most cases, are the same structures as those occupied by these Indians when the Spaniards first invaded Mexico. The successive terraces are ascended by ladders, and the entrance to the houses of the first and second stories above the ground had primitively no doors or windows, other than holes in the upper floors. The exemption in later years from danger of Indian attack has caused, in some cases, the opening of doors and windows in the lower stories.

The Pueblo Indians are pre-eminently an agricultural people and are among the best gardeners in New Mexico. They live, each tribe, on tracts of land granted them by the Spanish Crown, usually two leagues square, bounded by parallel lines each one league distant from the parish church, which thus occupies the centre of their domain, and their pueblo (town) is built on some convenient eminence which, in some instances, is a table-land almost inaccessible from the valley. They have a few cattle, small flocks of sheep and goats, and their ordinary beast of burden is the *burro* or small ass of the country. Sometimes in the fields they use oxen. Like the Aztecs, whom they in so many ways resemble, they are masters of the art of cultivation by bringing water artificially on

the land, and their irrigating ditches are well planned and well constructed.

Their social and religious customs, like their houses and dress, seem to have undergone little change through their long association with white people. They were all originally claimed as converts by the Catholic missionaries, but their new faith was one mainly of outward conformity, and the bulk of their primitive superstitions remained unchanged. Some, as the Zuñis, have openly returned to their old religion; others have mixed their former religious observances with the worship of Christ. In their *estufas* or religious council-chambers is maintained the sacred fire, and the traveller in New Mexico still can see these Indians, as he passes their pueblo in the early morning, standing upon their rooftops, motionless, gazing east in adoration of the rising sun. Their dances and processions on feast days, which they are fond of celebrating, are most picturesque and striking both in equipment and performance. Their temporal government is by a governor, a war captain, and a fiscal elected annually, but there is also in each community a cacique, usually an aged man, who holds his position for life, and who, assisted by a council of elders, wields a great influence in the pueblo. These communities are governed by their own local laws, and all cases of their violation are settled within the pueblo by its officials, whose decisions of award or punishment are unchallenged. In their relations with the whites, the Pueblo Indians are law-abiding, and it has rarely happened in modern times in New Mexico that one has ever been called before a territorial court of justice, and there is no instance on record that any criminal complaint has

ever been made by one Pueblo Indian against another in such a court.

Under the Mexican government, the Pueblo Indian had the standing of a citizen, and he entered the American republic, with all other Mexicans of the annexed territory, on the footing of an American citizen. He has, however, never chosen to exercise the electoral franchise thus conferred, and has always strenuously and, thus far, successfully resisted all attempts to tax him for territorial purposes. He is in practical conduct a most excellent citizen, being honest, peaceable, industrious, hospitable, and frugal. These people lend a picturesque feature to the life of New Mexican towns as they come in, men and women, clad in their characteristic garb, with processions of asses laden with hampers of fruit and vegetables, or with fagots of firewood gathered among the mountain pines.

Reference has before been made in this paper to the general similarity between the Pueblo Indians of New Mexico and the civilized peoples of Mexico at the time they were found by the Spaniards. The difference in language is the one very serious obstacle to the theory of a common origin of these races, and more extended studies of the philology of the ancient Mexicans and of the native tribes of the southwest may reconcile the seeming discrepancy in this respect. In this connection the words of Baron von Humboldt may properly be quoted, where he says in his chapter on New Mexico: "Every thing in these countries appears to announce traces of the cultivation of the ancient Mexicans. We are informed, even by Indian traditions, that twenty miles north from the Moqui, near the mouth of the Rio

Zaguananas, the banks of the Nabajoa were the first abode of the Aztecs after their departure from Aztlan. On considering the civilization which exists on several points of the northwest coast of America, in the Moqui, and on the banks of the Gila, we are tempted to believe (and I venture to repeat it here) that at the period of the migration of the Toltecs, the Acolhues, and the Aztecs, several tribes separated from the great mass of the people to establish themselves in these northern regions."

The Comanche Indian has disappeared from the plains of New Mexico, to which he was in former times a constant visitor, though his home, so far as he could be said to have a settled place of habitation, was in Texas. The Comanches are now living peaceably on their reservation in the Indian territory. They are a picturesque and formidable tribe, wild riders who fight on horseback and who were wont to make extended incursions for plunder into the northern states of Mexico. Of fine physique, great personal bravery, and magnificent horsemen, they were, until restrained on a reservation, the terror of the civilized inhabitants on both sides of the Mexican frontier. The Comanches have always stood pre-eminent among the Indians of the southwestern plains, and their language is the common medium of diplomatic intercourse between the various tribes of that region, or, as has been said, the Comanches are the court Indians, and their language the court language of the plains. They are of a peculiarly bright copper color, with better features than most Indians, and in many cases show strongly their intermixture with the whites through the many captives they have taken and adopted into their tribe. A compact of amity exists between the Comanches and the descendants

of the Spaniards in New Mexico, dating from a treaty concluded about a hundred years ago after a great defeat and massacre of Comanches by New Mexican forces. From that time up to a quite recent period, the Comanches were accustomed to find in New Mexico a market for plunder stolen from adjacent provinces or states of Mexico, and later from States of the American Union. The Comanche is commonly a well-equipped Indian, opulent in robes and ponies, and carrying himself with much pride of demeanor.

The worst scourge and terror to the civilized inhabitants of New Mexico, whether Spaniards, Mexicans, or Pueblo Indians, has ever been the Apache Indians, who, before they were placed on reservations a few years ago, were distributed through the low mountain ranges that, running north and south, divide the southern plains of New Mexico and Arizona. In all ages of his history the Apache has been an Ishmaelite, his hand against every man, and every man's hand against him, and, from motives of plunder and on general principles of his character, he has waged a merciless war on all people who are his neighbors or whom he may chance to meet. There are eight Apache tribes, all possessing similar characteristics, those, however, whose home is in the lower altitudes being the most inveterately predatory; and the total number in these tribes is about 8,000. The Apache is squalid, and low of stature, with a countenance indicating ferocity and treachery. He is often seemingly ill-developed physically, but his muscles are like iron, and he is active and capable of great endurance. On foot he can travel over a mountainous country fifty miles a day for weeks, and he can run eighty miles in a single day. He is the

cunningest of all Indians in ambush, a prairie weed, a stone, or even the white dust of the alkali plain serving him as an ambuscade ; and he can steal with wonderful adroitness. He is of untiring energy when on the war-path, and lives off the country wherever he goes, on cattle or sheep if available, and especially horse or mule flesh, which is his greatest delicacy ; but these failing, on game, helped out by field mice, lizards, worms, and edible roots and herbs, which he finds in the most unpromising country.

Ethnologically considered, the Apache has no affinity with any of the surrounding native peoples, except the Navajos directly north of him. He belongs to the family known as *Tinneh*, of which the representatives nearest in location beyond the Navajos are a tribe living in British America, called by the trappers *Montagnais*, whence the expression *Tinneh*, who inhabit a forest country, and are very timid. Their locality is north of the Assiniboines in the Lake Winnipeg region. North again of the *Montagnais* are certain *Tinneh* tribes inhabiting the country about the mouth of the Yukon and Mackenzie rivers, within the Arctic circle, which may be regarded as the fatherland of the Apache race.

The removing of the Apache tribes to reservations, from ten to twelve years ago, has not prevented bands of their warriors from making savage raids almost yearly upon the whites of New Mexico, Arizona, and the northern states of Mexico. These raids, within the last eight years, have twice amounted to the extent of wars. That of Victorio, with his tribe of Warm Springs Apaches, which began in 1879, lasted two years, and employed all the available military resources of the American and the Mexican governments to suppress it. The last outbreak

of Geronimo, which began in May, 1885, only closed in last September (1886). For sixteen months this chief, with only forty-two warriors, and accompanied by ninety squaws and children, waged successful war against both the Mexican and American republics, and kept the southwestern country in a state of terror. As a sequel to the last war, the two most inveterately hostile tribes, the Chiricahua and the Warm Springs Indians, were deported to the eastern coast of Florida, thus removing from the more pacific Apaches a dangerous and inflammable element.

The Navajo is a respectable Indian with bad antecedents, being of the same race with the dreaded Apaches, but of much finer personal appearance. The tribe is the most formidable in the southwest, numbering 17,200 souls, and these were in former times the most terrible foes the civilized inhabitants of New Mexico had to contend with. Up to a time less than twenty-five years ago their incursions upon the more exposed New Mexican settlements were continual. They destroyed or compelled the abandonment of many of the smaller hamlets, and swept the flocks and herds from a great area of plain and valley, driving their captured animals to their own country, where, instead of slaughtering them immediately for food, as was the custom of their kinsmen, the Apaches, they kept many of them under a rude form of pastoral life. Their depredations continued without serious check until the year 1863, during the American civil war, when the invading Confederate troops having been expelled from New Mexico, Colonel Kit Carson, the famous frontiersman, led the first regiment of New Mexico volunteers against them. After an arduous campaign, lasting

over a year, the Navajos were subdued, their flocks and villages destroyed, and the whole tribe removed to a military reservation in Eastern New Mexico, where they were closely guarded. Later, on promise of amendment, they were allowed to return to their own country, where their present reservation was assigned them, and they were supplied with cattle and sheep for breeding purposes. Since then their flocks and herds have multiplied and the tribe have become self-supporting. They have never again been on the war-path, though, as in the case of the Comanches, a few of their young warriors have occasionally stolen off the reservation to join the raiding Apaches.

The Navajos live in habitations consisting of a semi-“dug-out,” over which is reared a superstructure of saplings or adobe roofed with brush, upon which is thrown a blanket or a piece of army tenting. They practise a little agriculture, but their occupations are mainly pastoral. They weave, with the rudest implements, a heavy woollen blanket of brilliant colors and barbaric and intricate pattern. These fabrics are so closely woven that they may be used for the carrying of water. The Navajos also weave sashes of fine texture and beautiful design, and with a hammer beat silver dollars into massive silver finger-rings, ear-rings, bracelets, and charms. In the autumn they bring blankets and droves of ponies into the more northerly New Mexican towns for purposes of traffic. Among the Navajos, woman holds a more exalted place than with most Indian tribes, being the custodian of the family property, and having an important voice in all matters of domestic or tribal affairs. The Navajo, like the Apache, is un-christianized, and the

religious beliefs and observances of these tribes have a general similarity.

The New Mexicans of Spanish ancestry, known distinctively in New Mexico as "Mexicans," are of two classes, those of pure Spanish blood, known as Castilians, and those, by many times the greater number, of mixed Spanish and Indian descent, who are called by the Mexicans *Mestizoes*. The Castilians commonly belong to the class known as *ricos*, or the rich, who in former times held practically all the property in New Mexico. Under the Spanish and the Mexican rule, the purity of the Castilian blood was jealously guarded in the families of the *ricos*, and no matrimonial alliance was tolerated between them and any family of the mixed strain. Genealogies were carefully maintained, and were compared and consulted in reference to any proposition looking toward marriage. This feeling still prevails, though not in so marked a degree as before the annexation of New Mexico to the United States. Since that time some people of an Indian strain have come well to the front, are holders of considerable property, and exercise an important local influence.

The New Mexican *rico* usually lives in a large flat-roofed adobe house of one story, built about its square *placeta* or court-yard, on which open its verandas and windows, and to which admission from the street is gained through a covered gate-way and passage. In the town-houses a veranda commonly extends above the sidewalk in front. On two sides of the *placeta* are the apartments of the family, the others being devoted to domestic uses and quarters for servants. In a small community there will often be several such houses belonging to different members of the same family, the married sons or daugh-

ters, and they stand on the tract of land granted by the king of Spain or by the Mexican government to the ancestor who first came to New Mexico. About these great houses are the smaller dwellings of the poor Mexicans grouped irregularly about the *plaza* or public square, and peopled usually by the dependants and employees of the *ricos*. The church, with its bell swinging beneath an adobe arch carried up from its front wall, occupies one side of the plaza, and the *tienda* or village store completes the list of buildings. Sheep and cattle raising and the freighting of merchandise to and from points inaccessible by railroad are the principal sources of income of the *ricos*. The wealthy Mexican is a generous man, proud and inclined to be reticent with strangers, but the soul of hospitality to all who may visit his house. He is, from the circumstances of his surroundings and social life, accustomed to dominance over his inferiors, and a peculiar fraternity with those whom he regards as his equals in position ; but in either rôle he shows a uniform grace and courtesy, and is a not unworthy descendant of the iron-hearted *Conquistadores* who three centuries ago came north into the heart of the North American continent, and held the upper Rio Grande valley in the midst of an environing wilderness swarming with hostile Indian tribes.

The Mexican of lower caste carries in his features and dusky skin the evidence of the mixture of blood, the combination of ancestral races that have gone to make his pedigree. The Spanish and Mexican custom in all times of enslaving the children and young women of Indian tribes conquered by them, when taken in connection with their constant warfare with neighboring tribes in New

Mexico, and the fact, moreover, that the early Spanish garrison town was usually located on the site of or about an Indian pueblo, the population of which became gradually but certainly assimilated in generations with the conquerors, sufficiently explains the causes of the diverse ancestry of the average poor Mexican. As a class they are improvident, being content with little and seeing no need for working after their immediate wants are satisfied. The Mexican is a good shepherd or cowboy, an expert packer and an excellent ox-teamster. He is a fair laborer in the fields after the old fashion of the wooden plow and the heavy hoe, and he understands well the art of irrigation. He occupies, under some sort of title, a little plot of ground fronting fifty or a hundred *varas* on some stream, on which he raises corn for *tortillas*, and chile peppers which are the condiment in every Mexican dish. The adobe in the nearest clay bank affords him building material for his little house of one room, and saplings from the foot-hills are his rafters. If he is so luxurious as to desire a window that will exclude the wind and rain, he finds in the mountains transparent sheets of mica or of *yesso* (gypsum) which fill the small aperture for light. His wants are few, and he is contented with his lot. Morally his disposition and general characteristics are much influenced by the predominating elements derived through his ancestry. If he is mainly of Spanish or Pueblo Indian descent, he is presumably, though not certainly, a sufficiently good citizen, and may even, in rare cases, manifest some desire to improve his condition. If the Navajo, Apache, or Comanche Indian strain be considerable, he is always liable to reveal some trait characteristic of these naturally predatory and murderous peoples.

While New Mexico was a part of New Spain and, later, of the Mexican republic, its inhabitants were regarded by the more southerly Mexicans as possessing unusual courage and energy. These qualities they must certainly have had to have maintained themselves as they did, an isolated community, encompassed on all sides by active and formidable enemies. Between them and the nearest towns of their countrymen, which were on the south, the trail lay through the wilderness, following in part the Rio Grande, but leaving its valley to cross the Jornada del Muerto (Journey of the Dead), an arid desert hemmed from the river by ranges of barren mountains, on which, for a distance of eighty miles, the traveller found no water, and was continually exposed to attacks of Comanche or Apache Indians.

After the annexation of New Mexico to the United States, the territorial officials were Americans appointed from Washington, and military posts were established, garrisoned by United States soldiers, but there was no essential change in the appearance or customs of the people until the incoming of railroads in 1878 and 1880; the first, the Atchison, Topeka, and Santa Fé, advancing from the east, and the second, the Southern Pacific, coming from the west, connecting the territory respectively with the Atlantic and the Pacific sea-board. The first road lies almost due south through New Mexico, and connects with the Southern Pacific road at two points, Deming in New Mexico, and El Paso, just over the border, in Texas. There have since been built, the Atlantic and Pacific road from Albuquerque westward to the Pacific coast, and which is now a part of the Atchison, Topeka, and Santa Fé system, and an extension of the Denver and Rio Grande road from Colorado down the

Rio Grande valley to Santa Fé. There are in all nearly 1,000 miles of railroad within the territory.

With the advent of railroads came a population from "the States," which built new towns, in modern fashion and, in a measure, reconstructed old towns along the lines of road; and, so far, Americanized the country. The building of mining "camps" and "saw-mill settlements," in places which have offered sufficient inducements, have introduced a new feature of civilization in many places remote from the railroads. The extension of the public surveys over a great part of the available grazing land, and the establishment by the new-comers of great cattle ranches, covering this area through possession of "water rights," have changed the face and enlarged the resources of the territory. The employment of Mexicans in the building and maintaining of railroads, the running of saw-mills, and working of mines, and especially the extensive freighting incident to these industries, has brought them in contact with the English-speaking people, and, by raising the standard of wages, has enabled them to indulge in many luxuries before unknown and unattainable. The system of territorial laws is American, being modelled largely on the Missouri code, and is administered by American judges. Yet any change in the spirit and social institutions of the Mexican population is apparent rather than real, and the semblance of it disappears a few miles away from the path of the railroad. There is an innate spirit of conservatism in the native people, an adherence to old customs, that will make any essential change in their old fashions a matter of the remote future. The laws and legislative proceedings are published in both English and Spanish, and an interpreter is a necessary official in the legislature and every court of law. The Mexican population of the

territory, as compared with the American, are at least five to one, and this ratio will not materially change in a long time to come.

The unsettled condition of land titles arising out of the old Spanish system of granting lands in the colonies is a great bar to the rapid development of New Mexico. The Mexicans, holding their estates under grants from the crown of Spain or the republic of Mexico, had no trouble in maintaining their possessions under those governments at a time when land was plenty and their titles and boundaries were held sacred under the unwritten law of custom and old tradition. The lands of all Mexicans whose titles were valid under the Spanish and Mexican laws were, by the treaty of Guadalupe Hidalgo, to be confirmed to them, but to determine the validity of the separate claims and to define their boundaries has been a task that the American government has thus far ineffectually dealt with. This is not the occasion to enter into details of causes of the failure to promptly adjudicate and settle these important matters, but the estimated number of the private land claims asserting title under Spanish and Mexican grants in New Mexico is 500, of which, in the thirty-nine years since the formal annexation of this territory to the United States, only forty-eight have been acted upon and settled by Congress, the final tribunal before which these cases appear. The others stand still unsettled, and, to a great extent, unknown to the law, insecure to their claimants, yet menacing the safety of any homesteader who may settle on them as public domain under the land laws of the United States. The area covered by these claims when all shall have been presented will be not less than one sixth of the entire territory. The disastrous effect of

this condition of things on the prosperity of New Mexico needs no demonstration, and the saddest commentary on the situation is that at this late day Congress has not taken even the initiatory step in the permanent settlement of these private land claims by the enactment of an adequate law to meet the requirements of their proper examination and adjustment.

The proportion of the elements composing the population of 131,985, given New Mexico by the census of 1885, is about as follows: 100,000 people of Mexican descent, 9,200 Pueblo Indians, and 22,785 Americans not of Mexican descent, and persons of other nationalities. The capital, Santa Fé, contains a population of 5,970; it is an ancient town, and has always been of commanding importance in the Southwest. It is the political centre of the territory, the military head-quarters for the department of New Mexico and Arizona, and the ecclesiastical head-centre and Archbishop's residence in the Archbishopric of New Mexico, Colorado, and Arizona. The next town in size is Las Vegas, the principal commercial town, with a population of 5,089; six miles to the northwest of this town, and connected with it by a branch railroad, where the foot-hills of the Sierra Madre meet the plain, are the Las Vegas hot springs. Here one of the railroad companies has built a magnificent sanitarium; grounds have been laid out as a park, and fine hotels and bathing houses built; at these springs one may meet people from every part of the world. The other leading towns are Albuquerque, Socorro, and Las Cruces, all in the Rio Grande valley, with populations respectively of 4,870, 4,047, and 2,100. Silver City, in the southwest of New Mexico, has a population of 1,914, largely Americans, and is the most important mining town in the territory.

STONE-PASHA'S WORK IN GEOGRAPHY.

The death of Gen. Charles P. Stone (Pasha), which took place at New York, January 24, 1887, is a cause of universal regret in the geographical world, for through his position and influence he contributed largely to the extension of the geographical knowledge of Eastern and Central Africa. He was a man of great versatility of talent and an indefatigable worker. To the laborious duties of chief-of-staff of the Egyptian army, and of aide-de-camp and military adviser to the Khedive, he added those of President of the Khedivial Geographical Society of Cairo. He created and organized the Egyptian staff in 1870, and it was by his advice and under his direction that the following exploring expeditions (almost all commanded by American officers attached to that staff) were sent to the interior of Africa.

1871, COL. PURDY.—Exploration and map of the region between Cairo and Suez. Also of the route between Keneh on the Nile and Kosseir on the Red Sea.

1872, COL. MASON.—Exploration and maps of the Fayoum and of the oasis of Siwa (the site of the temple of Jupiter Ammon).

1873, COL. COLSTON.—Exploration and map of the ancient Roman military road from Keneh to Berenice on the Red Sea. Geological survey and maps of the deserts between the Nile and the Red Sea from Keneh to Berber.

1874, COLS. PURDY, COLSTON, AND MASON.—Hydrographic survey of the gulf and harbor of Berenice. Ex-

ploration and maps of the Ababdeh and Bishareen deserts between Berenice and Berber on the Nile, including a survey (by Col. Colston) of the ancient gold mines of Derehib in Wady Allakee, worked by the Ptolemies, and later by the Arabs, in the ninth century. Return by the Korosko route.

1874, LT.-COL. ABD-EL-KADER (*native*) AND MAJOR FECHET (*American*).—Exploration of the region between Assouan and Berber, returning by the Korosko route.

1874, COL. LONG ascends with GORDON to Gondokoro on the White Nile. Thence he proceeds on a mission to M'tesé, King of Uganda, on Lake Victoria. On his return he discovers Lake Ibrahim, and ascertains the identity of the Nile with the Somerset River. 1875.—He leads an expedition from Lerdo into the country of the Makraka-Niam-niams.

1874–5, COL. COLSTON ascends the Nile to Debbeh, explores and maps out the route from that point to El Obeïd, the capital of Kordofan, which he reaches in what was supposed to be a dying condition, and transfers the command to Col. Prout, who has just joined him. After six months' convalescence, he is transported by camel-litter to Khartoum, and thence by the Berber and Suakim route to Suez and Cairo.

1875, COL. PROUT surveys and makes a map and profile of the Suakim-Berber route, and joins Col. Colston at El Obeïd. He explores and maps out the province of Kordofan and a portion of Darfour.

1874–6, COLS. PURDY AND MASON ascend the Nile to New Dongola, and explore the route from that point to El Fasher, the capital of Darfour. Joined by Col. Prout, they explore and map out the greater part of Darfour,

until then almost unknown, and rectify astronomically the position of El Fasher, locating it nearly three degrees further west than was marked on previous maps.

1876.—Explorations and maps of the region S. W. of Massowah, by COLS. LOCKETT and DERRICK, and PROF. L. H. MITCHELL. Also of the districts of Berbera and Harrar by LT.-COL. MOHAMMED MOUKTAR.

1875-1879.—Extensive explorations and maps of the White Nile as far as the lakes by GEN. GORDON and his officers. Explorations of the Juba River by COLS. Ward and Long.

1878, COL. MASON circumnavigates and surveys Lake Albert Nyanza. Lt.-Col. Graves makes a survey of Cape Guardafui.

The geographical information obtained by these expeditions was of immense value. It was embodied in a magnificent map, twelve by fifteen feet, constructed under Gen. Stone's supervision by the officers of the Egyptian staff. This map was awarded a medal of honor at the World's Exposition in Paris in 1878.

Gen. Stone accomplished a great work for Egypt in the organization of the scientific staff of its army and the creation of regimental schools for the instruction of the rank and file. His work was unfortunately wiped out of existence by the British occupation of Egypt—but the scientific results accomplished by the exploring expeditions organized and directed by Gen. Stone's care and foresight will remain an enduring record of his valuable labors.

R. E. COLSTON,

Formerly Col. Gen. Staff, Egyptian Army.

GEOGRAPHICAL NOTES.

GEOGRAPHICAL SPELLING.—If, as Dogberry says, to write and read comes by nature, it is at least quite certain that nature does not know much about spelling, as applied to geography. There is so far but one recognized principle which seems to be followed with some steadiness; and that is, to adopt the native orthography for names of places in countries which use the Roman alphabet.

This principle is applied to all the Western Continent, to all Europe, with the exception of Russia, the Balkan States, Turkey, and Greece, and to many of the European colonies.

The countries which still use some form of the Gothic character come under this rule, for the reason that the Gothic is not a true character, but a mere distortion of the Roman form. Every sound represented by a Gothic letter is represented equally by the corresponding simpler Roman letter, and the manifest disadvantage of keeping up a distinction which is no distinction is so great that German and Danish and Swedish scholars have gone over, almost in a body, to the side of common-sense and the Roman alphabet.

Exceptions to the general principle just stated will occur to every one; but they are all concessions to long-settled habit.

There is no reason, logical or sentimental, why Roma,

Firenze, London, Edinburgh, New York, München, Wien, and Lisboa should not be written unaltered in every language that uses the Latin alphabet. The foreign name is sure to be incorrectly pronounced in any case, but it might always be correctly and uniformly written and printed; and this would be no slight gain. To introduce uniformity of practice in this matter among most of the Europeans and all of the Americans is in the power of the first nation that sets the example.

It is less easy to deal with names written in the Greek or the Russian character; but the difficulty lies not so much in finding what Latin letters shall represent a given Greek or Russian letter as in agreeing upon the value of the combined letters; whether, that is, they shall be given their German, or their French, or their English value. There is as yet no tribunal to settle this question, or the still more difficult one of how to arrange, for the use of those who employ the Latin alphabet, a system that shall render the Oriental names and sounds in a spelling recognized by all.

To attempt too much would be to fail; but an entirely practicable reform lies within reach. This is to establish rules by which those who write in English shall be guided in spelling the names of strange places, so that all those who read English shall be able to pronounce them in the same way.

One or two examples, taken at random from the "*Gazetteer*," will show what is the existing confusion in this matter.

Ha-Noi, in Annam, is known also by the following names: Ketho, Kesho, Cachao, Kecho, Cacheo, and Bakthian, and Baktean. All these forms are found in English books.

Voronezh, a well-known Russian city, is found in English under these additional shapes: Voronej, Voroniej, Voroneje, Voronetz, Woronetz, and Woronesch.

As matters now stand the traveller or reader has no authority to guide him, either in spelling or in pronunciation.

The Royal Geographical Society adopted in 1885 a system, intended to supply the want of an English standard for the orthography of names not written, in the countries to which they belong, in the Roman character. The rules laid down in this system are in part excellent, but they might be improved by a thorough application. Exceptions are out of place in a radical reform.

The rules adopted are:

1.—No change to be made in the spelling of names in countries which use Roman letters.

2.—No change to be made in the spelling of names familiar by long usage to English readers, though belonging to languages not written in the Roman character: as Calcutta, Cutch, Celebes, Mecca.

3.—The true sound of the word as locally pronounced to be taken as the basis of the spelling.

4.—An approximation, however, to the sound is alone aimed at.

5.—The broad features of the system are that vowels are pronounced as in Italian, and consonants as in English.

6.—One accent only is used, the acute, to decide the syllable on which stress is laid.

7.—Every letter is pronounced. When two vowels come together, each one is sounded clearly, however rapidly.

8.—Indian names are accepted as in Hunter's "Gazetteer."

In detail these rules are as follows :

a—*ah*, *a* in *father* ; Java, Banána, Somáli, Bari.

e—*eh*, *e* in *benefit* ; Tel-el-Kebir, Otétch, Yezo, Medina, Levúka Peru.

i—English *e* ; *i* as in *ravine* ; the sound of *ee* in *beet* ; Fiji, Hindi.

o—*o* as in *mote* ; Tokio.

u—long *u* as in *flute* ; the sound of *oo* in *boot* ; Zulu, Sumatra.

All vowels are shortened in sound by doubling the following consonant : Yarra, Tanna, Mecca, Jidda, Bonny.

Doubling of a vowel is only necessary where there is a distinct repetition of the single sound : Nuulúa, Oosima.

ai—English *i* as in *ice* ; Shanghai.

au—*ow* as in *how* ; Fuchau.

ao—slightly different from above ; Macao.

ei—is the sound of the two Italian vowels, but is frequently slurred over, when it is scarcely to be distinguished from *ey* in the English *they* ; Beirút, Beilúl.

b—English *b*.

c—is always soft, but is so nearly the sound of *s* that it should be seldom used ; Celebes. If *Celebes* were not already recognized it would be written *Selebes*.

ch—is always soft as in *church* ; Chingchin.

d—English *d*.

f—English *f* ; *ph* should not be used for the sound of *f* ; Haifong, Nafa.

g—is always hard (soft *g* is given by *j*) ; Galápagos.

h—is always pronounced when inserted.

j—English *j* ; *Dj* should never be put for this sound ; Japan, Jinchuen.

k—English *k* ; it should always be put for the hard *c* ; Korea.

kh—the Oriental guttural ; Khan.

gh—is another guttural as in the Turkish Dagħ, Ghazi.

l
m } —as in English.
n }

ng—has two separate sounds, one hard as in the English word *finger*, the other as in *singer* ; as these two sounds are rarely employed in the same locality, no attempt is made to distinguish between them.

p—as in English.

q—should never be employed ; *qu* is given as *kw* ; Kwangtung.

r
s
t
v
w
x } —as in English ; Sawákin.

y—is always a consonant, as in *yard*, and therefore should never be used as a terminal, *i* or *e* being substituted. Thus, not Mikindány, but Mikindáni ; not Kwaly, but Kwale.

z—English *z* ; Zulu.

Accents should not generally be used, but where there is a very decided emphatic syllable or stress, which affects the sound of the word, it should be marked by an *acute* accent : Tongatábu, Galápagos, Paláwan, Saráwak.

The second rule is clearly wrong. Who is to decide what is meant by long usage ? The words given as illustrations fall readily and properly into their places when spelled : Kalkutta, Kutch, Mekka, Selebes.

The third and fourth rules are in reality but one, and might, even then, be suppressed. It is, in any case,

only an approximation to the true name that can be made; for where no common standard exists, what certainty is possible? The speaker is one, as the Arab says, and the hearer is another; some men articulate badly in speaking, and others have a dull sense of hearing. What becomes of the true local pronunciation in such cases? The eighth rule, establishing Hunter's "Gazetteer" as the authority for the spelling of Indian names, is no rule at all, for it brings the student face to face with a dilemma like the famous one in the story of the Alexandrian Library. Either the "Gazetteer" agrees with the rules, and then it is superfluous; or it contradicts them, and then it is pernicious.

The system, it ought not to be forgotten, is intended to establish principles for the guidance of the English-speaking peoples; and it should carry with it its own explanations. There should be no place in the alphabet for diphthongs like those given, *ai*, *au*, *ao*, *ei*. The one sufficient rule has been already laid down, that every vowel is to be pronounced. The letter *c* should be thrown out as unnecessary. *Celebes* should be written *Selebes*, and *Comoro*, *Komoro*. Practice, moreover, should go with precept. The letter *y*, it is said, is always a consonant, and must not be used as a terminal; but the name *Bonny* appears among the examples, a few lines above. Consistency in practice has also its value. Why should *Mikindány* be corrected *Mikindáni*, and *Kwaly* be made *Kwale*? The terminal *i* is surely sufficient.

It falls properly to the Royal Geographical Society to perfect the work, of which it has made so good a beginning.

THE UNITED STATES OF AMERICA.—The American Geographical Society is constantly receiving communications with the address:

“New York,

“United States of *North* America.”

It ought to be known by this time, in most parts of the civilized world, that there is no such country.

The name of the American Union is the one given at the head of this note, and to thrust in the word *North* is to betray a lack of the elementary information, supposed to be general in these days of geographical study.

London, it may be well to say, is not in “England of Europe,” nor is Berlin in the “German Empire of the North.”

DIVISIONS OF THE SOUTHEASTERN U. S.—Mr. Gilbert Thompson, of the U. S. Geological Survey, suggests, in a communication to the Philosophical Society of Washington, the adoption of designations corresponding with the topographical features of the sections in the Southeastern States of the Union.

In this Appalachian region, he says, the drainage does not afford the best unit for the purposes of the physical geographer. There is, however, a remarkable line known as the “fall-line,” the natural boundary of a division. Every river in the Eastern United States, south of New England, ceases to be rapid as it nears the sea and becomes broad and slow-moving. Where this change takes place, there is usually a fall or rapid.

This is always the lower limit of water power and often the upper limit of navigation, and it is the natural seat of cities and towns of importance. In its northern portion it is at the head of tide, and it nowhere exceeds 200 feet in altitude.

From the fall-line to the sea is a region with a gentle slope, traversed by slow-moving rivers and fringed at almost a dead level by deltas, swamps, and everglades.

This region Mr. Thompson, with courage worthy of a better cause, entitles the "*coastal plains*," including as subdivisions the Atlantic plains and the Gulf plains.

The area bounded by the fall-line, the Mississippi and Ohio, and a part of the drainage divide of the Laurentian lakes, he calls in a broad sense the Appalachian region, and divides it into three distinct sections.

From the Ohio southeastward, and from the Mississippi eastward, the country gradually rises to 2,500 feet above the sea, and is then cut off by an escarpment facing to the southeast and about 1,200 feet in height. This plateau Mr. Thompson proposes to call the "Cumberland plateau." It is a table-land deeply cut by a system of ramifying drainage. At the north the surface is somewhat rolling, and the plateau ends at the south in long finger-like spurs. The streams generally rise near the edge of the escarpment and flow toward the northwest. The Potomac, however, flows eastward, and the New and the Tennessee rivers flow westward.

From the Cumberland plateau eastward to the eastern foot of the Blue Ridge is the "Appalachian region," definitely so called. This is characterized by long, narrow mountain ridges, closely parallel, and sinking to the rank of hills in the great valley which traverses the region from north to south. At the north the principal mountain area is west of this valley and the Blue Ridge is east of it. At the south the valley is close to the Cumberland plateau.

The third section is the "Piedmont region," an undu-

lating plain, with low spurs from the mountains and occasional isolated hills. The streams here are rapid and the topographic relief diminishes toward the fall-line.

Mr. Thompson's classification needs, most of all, a good commodity of names, for the burden laid upon the Appalachian region is greater than it can bear. The essential thing is to have one name for one region; but any extended composition, in which Mr. Thompson's divisions were adopted as they now stand, would call for a perpetual commentary.

CHAMPLAIN CANAL.—*L'Esplorazione Commerciale*, of Milan, has information of a plan formed in the United States for a canal to unite the Hudson and the St. Lawrence rivers by way of Lake Champlain. This canal, it is thought, will permit ships to pass directly from New York to Montreal, and will enable them to avoid the difficult and dangerous navigation of the Gulf of St. Lawrence, and the ascent of the great river. It will allow ships of 1,000 tons to go from New York to Chicago through the great lakes, Michigan, Erie, and Ontario, so that Chicago, distant though it be from the ocean, will become a seaport. The great inland city, which has already sent cargoes of grain direct to Liverpool, may receive the news of its coming sea-change with calmness; but the people of New York, with whom it is an article of faith that the Champlain Canal was finished in the year 1822, will wait with some impatience for more precise details from Milan, where it has been found necessary to print the notice of this enterprise in two separate numbers of *L'Esplorazione Commerciale*.

The unassisted American intellect finds itself bewil-

dered in attempting to grasp the idea of a plan which places Lake Erie to the east of Lake Ontario and Lake Ontario itself far to the west of Lake Michigan, and forgets to speak, even in a disrespectful way, of Lake Huron.

It is, perhaps, not irrelevant to remind the Milanese geographical journal that the Tagliamento is not the outlet of the Lago di Como, and that it were in vain to look for the Lago di Garda to the northwest of Lago Maggiore.

THE SOURCES OF THE MISSISSIPPI.—The Minnesota Historical Society, of St. Paul, on the 13th of December, 1886, ordered an investigation of the claim put forward by Capt. Willard Glazier to the discovery of the source of the Mississippi, and now publishes the report of the Hon. James H. Baker on the subject.

This report is less than complimentary to Capt. Glazier, and the Society, after adopting it, passed several resolutions, one of which reads :

“Resolved, That we call upon the various geographical, historical, and other learned societies throughout the world to join with us in repudiating Glazier's claims, and ask them, in the spirit of right and truth, that if they have in their possession maps with the lake in question so named (Lake Glazier), they erase Glazier's name from them and substitute therefor that of “Elk Lake.”

KOSMOS.—The first number of this handsome monthly was issued at San Francisco, February 1, 1887, by the Kosmos Publishing Co., C. Mitchell Grant, F.R.G.S., editor.

Kosmos is the official organ of the Geographical Society of the Pacific, and contains, besides the Report of the Society's Annual Meeting, a paper on “Mt. St. Elias,” by Mr. Seton-Karr, who accompanied Lt. Schwatka's expe-

dition, and one by Prof. George Davidson, on the "Submarine Valleys of the Pacific Coast." Prof. Davidson marks three of these valleys. The first, off Shelter Cove, 30 miles S. of Cape Mendocino, is 100 fathoms deep at its head, $1\frac{1}{4}$ miles from shore, and 25 fathoms at the rocks almost under the cliffs; but where it breaks through the marginal plateau the depth reaches 400 fathoms. The sides of this valley are very steep.

Midway between this and Point Gorda is a minor submarine valley of from 300 to 150 fathoms deep; and immediately N. of the point a very deep valley comes in from the W.S.W. and heads close to the shore. The head of this second valley is $\frac{1}{3}$ of a mile from the shore— $40^{\circ} 18' 30''$ N. Lat. The depth of 100 fathoms in the valley is only $1\frac{1}{2}$ miles from shore, and the sides are remarkably steep. The opening through the 100-fathom plateau is 520 fathoms deep.

A little nearer to Cape Mendocino is the third valley, which comes in from the W. The depth of 100 fathoms in this is only $\frac{1}{3}$ of a mile outside of the regular 25-fathom coast line, and five miles S. by E. from Cape Mendocino light-house. The 450-fathom sounding in the entrance to this valley is $6\frac{1}{2}$ miles S.W. by S. from Cape Mendocino. The bottom is green mud.

Steam coasting vessels bound for Humboldt Bay, when they get as far as Shelter Cove in fogs, common on that coast, haul inshore to find soundings, and may be lost through ignorance of these deep valleys.

Through these, also, Prof. Davidson believes, the deep-sea fauna must be brought under the shores with the colder waters coming down the coast outside of the inshore eddy current to the northward.

LAKE MISTASSINI.—The Annual Report of the Geological and Natural History Survey of Canada, Vol. I., for 1885, gives the results of the exploration of this lake in 1884.

The lake is long and narrow, and lies N.E. and S.W., between 50° and $51^{\circ} 24'$ N. Lat., and $72^{\circ} 45'$ and $74^{\circ} 20'$ W. Lon. It is somewhat curved in shape, with the concave side towards the S.E. Its length in a straight line between the extremities of the N.E. and S.W. bays is nearly 100 miles, and the average breadth of the main body is about 12 miles. From end to end of the lake is a chain of rocky islands, almost like a ridge, dividing the water into two parts; and these islands so overlap each other as almost to cut off the view of the opposite shore from either side. From island to island the water is very shallow, but between the islands and the shore it is said to be everywhere deep.

The two soundings reported gave 374 and 279 feet. The shore line is indented with bays, more numerous and more irregular in the western part.

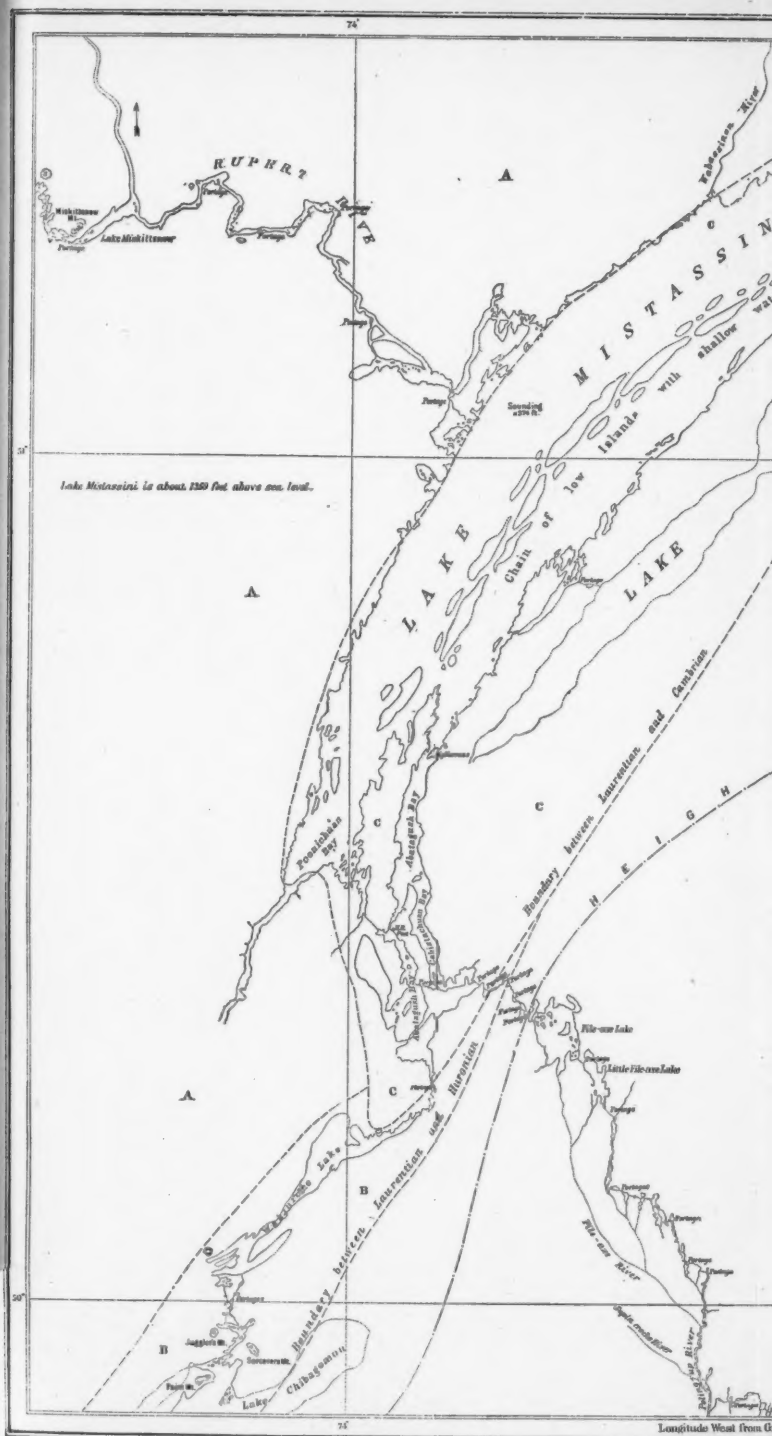
Many streams flow into the lake, but the shores are mostly rocky, and without beach or marshes. The elevation above the sea is 1,350 feet.

The climate is severe, observations at the Hudson Bay Company's post in 1884 and 1885 showing that frosts occur in every month except July. At this post, the most favorable point for agriculture, some poor potatoes are raised; but the tops are always frozen before they reach maturity.

No timber of commercial value was found near the lake.

The waters of the Mistassini, as well as those of the adjoining large lakes, are full of fish, principally lake-trout, river-trout, white-fish, pike, pickerel, and suckers,

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all of good size and fine quality. These fish are caught in great numbers by the Indians and by the Hudson Bay Company's people.

The Indians, about 125 in all, belong to the Mistassini tribe of the Algonkin family. They barter with the Company the skins and furs which they obtain during the winter; but they depend for subsistence on the supplies furnished at the post, there being no deer in the country. Most of them can read and write the Cree character, and they all profess Christianity, though they mingle with it their old beliefs and practices.

A missionary visits them from Hudson Bay every two or three years to perform the ceremonies of marriage and christening. During his absences the church service is conducted by one of the Indians.

This report effectually disposes of the stories about the vast size of this lake, longer and wider, it was maintained until very lately, than Lake Superior itself. Its area is found to be in reality about one fifth that of Lake Ontario.

MEXICAN GEOGRAPHICAL SOCIETY.—It is gratifying to know that this society intends to resume the publication of its *Boletin*, which has been suspended since 1882. The volumes already printed are most valuable.

LAKE NICARAGUA AND THE CANAL.—Under this heading *Ausland*, of Stuttgart, gives in its number 52, for 1886, a portion of a study of the line for the projected Nicaragua Canal by Engineer Ronfaut. It is not said whether Mr. Ronfaut undertook his study for his own satisfaction, or on behalf of *Ausland*, or as the agent of some government or company; and the matter is com-

paratively unimportant, in the presence of the study itself, which contains a really surprising amount of misinformation.

Mr. Ronfaut says the lake is ill-fitted for navigation, on account of the peninsulas, volcanoes, and rocks which fill it. In this opinion he is singular, and sets himself in opposition to the unanimous testimony of all the competent men who have studied the lake, and declare it to be a noble inland sea.

The trade-winds, he says, prevail for a part of the year, but there are complete calms of from two to five days' duration, followed by storms as terrible as those of the English Channel.

The facts are that the trade-winds blow almost throughout the year, from the east, northeast, and southeast during the dry season, and from the southeast in the rainy season. There is an occasional calm of a day or two, and sometimes, in June or October, the wind hauls to the southwest, with heavy rain for a week or ten days. This is the description of the weather given by all who have lived in Nicaragua, and notably by Dr. Earl Flint, of Rivas, who has been a resident of the country for thirty-five years. Dr. Bransford, a surgeon of the U. S. Navy, quotes, in the New York *Sanitarian*, of February 22, 1883, a memorandum of the U. S. Signal Office with regard to this region, as follows: "Exempt from hurricanes and whirlwinds, owing to the constant movement of air across the Isthmus from the trade-winds, although light in rainy season."

Mr. Ronfaut admires the scenery near Lake Nicaragua, but he says there is nothing to eat in the country, and that water is not to be had except by paying for it. With so

many storms as he describes there should be water ; and when he says there is nothing fit to eat he means, no doubt, nothing that seems to suit his own presumably peculiar tastes.

Other strangers in Nicaragua find beef, all kinds of vegetables, tropical fruits, sugar, chocolate, and coffee everywhere within reach at ridiculously low prices.

Timber, says Mr. Ronfaut, is abundant, but so costly, on account of the bad roads, that it is practically useless. The fact is that the internal communications in Nicaragua are fairly good. There are many and well-kept cart-roads, besides the lakes and the rivers. It is sometimes cheaper to use imported lumber at the seaports ; but everywhere else the excellent native wood can be had for the mere cost of cutting it.

The question of health is an important one. Mr. Ronfaut says that the climate of the Pacific coast is unfavorable to Europeans, that San Juan del Sur is in especially bad repute, that the valley of the San Juan river is deadly and fever-stricken, and that Greytown is one of the most unhealthy ports of the western world.

Dr. Bransford, the surgeon already quoted, says : "There are, of course, to be expected malarial troubles, but in few States of the Union are the lowlands free from the same class of diseases. . . . The strong and almost constant movement of the air in this section prevents that stagnation which, in a damp, tropical country is accompanied by accumulations of malarial poison."

Dr. Bransford was in Nicaragua with a surveying party of forty-five, many of them seamen, a proverbially reckless class, for 6½ months in 1872-73.

The average roll was 36. There was no death. One

officer had a sun-stroke, and there was one case of chronic dysentery, contracted before the patient joined the expedition. There was a marked absence of the bowel complaints for which the tropics are noted; and the natives were found to be remarkably healthy.

Dr. Bransford says in conclusion what the experience of so many confirms: "He is convinced that most of the cases of fearful mortality recorded of expeditions in the tropics were the results of gross ignorance and carelessness. Men cannot live in Central America as they would in New York, nor can they live in New York as they would at the North Pole."

Not every one visits Central America or the North Pole, but all men live through the year, and no one of them pretends to live in summer as he does in winter.

It may be satisfactory to Mr. Ronfaut to read what Dr. Bransford says of the deadly Greytown: "On the beach near Greytown, but away from the quarters, should be established a hospital, which would be an excellent sanitarium at certain seasons for men who break down, working inland."

Mr. Ronfaut is quite certain that earthquakes would shatter and dislocate the locks and the bed of a canal in Nicaragua. He would be a bold man who should set a limit to the power of earthquakes; and it is true that Nicaragua does not seem to be more exempt from these convulsions than most other portions of the earth's surface. Does Mr. Ronfaut know of any region in which engineering works are safe from the disturbing operations of natural forces?

The earthquake of Sept. 6, 1882, which was so destructive at Panama, has left no traces in Nicaragua; but if

Mr. Ronfaut's theory of earthquakes is correct it is his duty to explain why the blackened and weakened ruins of Granada, in Nicaragua, burned during Walker's foray in 1855, are still standing as they stood then.

The evidences of an imagination, overheated, possibly, by the dread of fever and of wild beasts, abound in Engineer Ronfaut's narrative. He discovered sharks in Lake Nicaragua; and he evidently mistook the marks of weathering on the houses of Managua for cracks made by earthquakes. Throughout Nicaragua there are to be found many stone dams, indigo vats, and other structures in stone and rubble, built during the Spanish domination and in perfect condition at this day.

Mr. Ronfaut has gloomy forebodings with regard to the future of Nicaragua. He asserts that the level of the lakes is sinking rapidly, and that the day is not far distant when they will be dried up. The river San Juan, he says, is becoming less and less navigable and must before long cease to exist.

This melancholy state of things is due, he conceives, to two causes: the rapid destruction of the forests, and the porous nature of the volcanic soil, through which the water of the lakes runs as through a gigantic sieve.

Mr. Ronfaut's sympathetic nature does him infinite credit, but the case is, perhaps, less hopeless than he thinks. He has told us that the people of Nicaragua live upon bananas and have no industries. It is not easy to understand how, under such circumstances, the forests of the country should be cut down, more or less rapidly; and it seems to contradict all known natural laws that Lake Nicaragua should ever have come into existence in a soil which cannot hold water.

Mr. Ronfaut's reasoning, or his memory, or both, may be at fault. The people who live in Nicaragua know nothing of the ruin that awaits them. The wharves built by the Spaniards on the shores of the lake are in use to-day, without any noticeable change in the depth of water; the extreme rise and fall of Lake Nicaragua, within the range of four to five feet from the end of the dry season to the end of the rainy season, has remained unchanged from 1850, when the first accurate surveys for a ship-canal were made by Col. Childs, to the present time; and the careful gaugings of the river San Juan, made at corresponding dates during these thirty-seven years, fail to show any diminution or marked fluctuations in the volume and flow of its waters.

No intelligent person, acquainted with the fact that the San Juan is the only outlet of a water-shed of 2,400 square miles, will expect to see it disappear.

The clearing of the harbor at Greytown and the construction of proper works there and at Brito present no unusual difficulties, and call for no extraordinary outlay of funds.

COMMANDER TAYLOR ON THE NICARAGUA CANAL.—In *Petermanns Mittheilungen*, Band 32, No. 11, Commander Taylor is made to say that the chief superiority of the canal by way of Nicaragua over the Panama Canal consists in the absence of calms on the Pacific at the terminus of the former. A careful re-reading of Commander Taylor's address in this Society's Bulletin No 2, for 1886, will show that the notice in the *Mittheilungen* omits several of the points established by him and, so far, fails to do him justice.

The address made it clear :

That the cutting of the Nicaragua Canal presented no unusual engineering problem ;

That the canal could be made, on the most liberal estimates, for \$75,000,000 ;

That the revenue of the canal, on a moderate estimate of the shipping both ways, and at the average rate paid on the Suez Canal, would yield a return of sixteen per cent. on the total capital invested, after deducting cost of maintenance and working expenses ;

That the great fresh-water lake gave to the route through Nicaragua a ready-made water-way of ninety miles in length, an inexhaustible reservoir, harbors, and anchorage grounds for the fleets of the world, ample sites for depots, dock-yards, coaling stations, storehouses, and hospitals on the lofty islands, and, always ready, a natural, effective, and inexpensive remedy for the fouling of ships' bottoms ;

That vessels entering the Pacific from the Nicaragua Canal would not be delayed by calms.

ARGENTINE REPUBLIC.—The Argentine government has just established in Paris, London, Berlin, Vienna, New York, Brussels, and Berne, bureaux for the purpose of furnishing gratuitously every kind of information concerning the Republic, its laws, resources, condition, progress, commerce, finances, and industries.

Each bureau is provided with a library of publications, official and private, besides maps, views, plans, etc., and the principal journals of Buenos-Aires and other cities ; and will maintain, also, a permanent exhibition of the products, natural and manufactured, of the country.

Dr. D. F. King has been appointed director in charge of the New York Bureau.

CARTOGRAPHY OF THE EGYPTIAN SOUDAN.—Under this heading *Le Mouvement Géographique*, of Brussels, publishes in the number of Jan'y 30, 1887, on the somewhat doubtful authority of the *Bosphore Egyptien*, the following story:

When the English army took possession of the citadel at Cairo, the maps, plans, and military archives there found were transported to the building occupied by the Bureau of Accounts for the Soudan. Here they were classified and catalogued.

Last June Gen. Hallam Parr, finding the rooms in which these documents were kept to his liking, gave directions to Maj. Mantell, who was in charge of the maps and plans, to give up his rooms and to take advantage of the occasion, when he moved, to destroy all the useless papers. Maj. Mantell ordered, in consequence, and carried out the complete destruction of the greater part of the documents entrusted to his care.

This is an almost irreparable loss, many of these maps covering former Egyptian provinces which are now inaccessible. The collection having been disposed of, the head of the department suppressed the division of "Maps and Plans," provided for in the budget, and effected in this way a retrenchment, if not a reform.

Le Mouvement Géographique adds that its own private advices confirm the story told by the *Bosphore Egyptien*, incredible as such an act of vandalism seems, when reported of an English officer.

Some idea of the treasures thus lost to geographical

science may be had by looking through the summary, elsewhere given, of the explorations made, principally by American officers, under the direction of Stone-Pasha, Chief-of-Staff of the Egyptian army; and these formed but a part of the collection in the citadel of Cairo.

FERNANDO PO.—In the *Bulletin* of the Paris Geographical Society, M. L. Janikowski gives some curious particulars about the island of Fernando Po, which lies in the Bight of Biafra, at about 20 miles from the mainland. Being but 3° N. of the equator, the island enjoys a healthful climate, which is due to its great elevation. The extreme length from N. to S. is but 35 miles, and the breadth 14, while the interior is a mass of mountains, of which the loftiest, known to the English as Mt. Clarence, and to the Spaniards as Isabel, rises to the height of more than 10,000 feet.

Less than fifty years ago it was in the power of the English, who must occasionally regret having allowed it to slip from them into the hands of Spain. M. Janikowski praises the beauty and the fertility of the island, which produces coffee, cacao, quinquina, every variety of fruit, and a great many medicinal plants, besides a number of very virulent poisons.

The natives, who should know best, call each other Boobis, a word equivalent in their language to *friends*. They number about 30,000, and their manners and customs are, to say the least, original. In their own villages they dispense with clothing, other than the shell bracelets and necklaces of which they are very fond; but when they enter the town of Sta. Isabel they add a cloth or skin apron. They are great hunters, and have a military

organization of their own, by means of which they enforce a rude justice throughout the island. There are three classes, the lowest, a middle class, and a privileged, or patrician, class, to which any *Boobi* may be chosen who can give a great dinner with abundant brandy and palm wine. When the feast is over, the guests solemnly elect their host a *butuku*, or noble.

The religion of this singular people resembles nothing so much as what is popularly called spiritualism. There are no temples, no fetiches, no images. The people come together in a grotto, of which there are many in the island, and seat themselves in profound silence. All at once, a voice cries: "Now, I open the window," and a bright light from above fills the grotto, and the priest is seen standing in front of the people. Each one, in turn, approaches with his offering and asks for an answer to his question: whether he will have good luck on his voyage, whether his father was not poisoned, and so on. The priest turns to the wall and puts the question to the *oomo*, or great spirit, in a peculiar tongue. He then falls to the ground in a kind of convulsion, and a loud voice cries out some words, which are the answer, as interpreted by the priest. An English negro, who was present on one of these occasions, told M. Janikowski that the *oomo* asked him in good English what he wanted. He replied that he wished to know something about the death of his father; and the answer came to him at once, with some details concerning his family.

Marriage is a simple affair. If a girl pleases the eye of a rich man, he sends an agent to throw a shell necklace over her neck, and she is won without more ado.

Poor men are obliged to make several visits to the

parents, leaving always a present, and one day the girl is told to get up and go to the lover's house. Here she is received by an old woman, and the marriage is made.

Family ties are not very strong. M. Janikowski tells of an only son whose mother died, leaving him a house and some small debts. The son refused to pay the debts, and was brought before the Spanish court by the creditors. When asked where he was born, and the names of his parents, he denied any knowledge of them; and being reminded that he had just buried his mother, he declared that the dead woman was not his mother but a stranger, with whose debts he had no concern. "In that case," said the judge, "what right have you in her house? You must leave it at once, and it must be sold to satisfy her creditors." "Oh! no," cried the man, "now that I remember, the deceased was my mother, and I will pay."

M. Janikowski affirms that this case is but one of many which prove the lack of natural affections among these people. It is not surprising, under these circumstances, to learn that poisons are habitually employed to remove wives and children and husbands, who persist in living.

When a death occurs, all but the nearest relatives leave the house. The poor are buried without any ceremony or attendance. The body of a *butuku*, or rich man, is dressed in his best—gigantic round hat, bracelets, and all. The wall of the house is then broken down, and the body is taken out through the opening and into the forest, where a deep hole has been dug, covered at the bottom with bags of rice, in the middle of which is placed a semi-circular seat taken from a canoe. Here the body is made to sit with the hands on a tree set up immediately before it. The earth is then thrown in, amid the discharge of fire-

arms; and the tree, projecting above the ground, marks the place of the grave.

It has been said that the island is, on the whole, a healthy place, but it has its diseases, and to one of these M. Janikowski gives the mysterious English name of *yellow gender*.

To a race of self-confessed Boobis any kind of grammatical distinction may very well seem to be nothing less than a visitation of God; but other men find it difficult to form a conception of a yellow gender, or a purple declension, or a crimson syntax.

M. Janikowski is, probably, not familiar with spoken English. The name he heard and ought to have written was, undoubtedly, *yellow jaundice*.

THE SHARPLESS PORTRAITS.—The facts concerning these portraits cannot be too widely known, since it equally concerns all men, whatever their special pursuits may be, to aid in defending and maintaining the integrity of historical records and monuments.

A few years before the death of Washington an English painter, named Sharpless, visited America and made many portraits, chiefly in crayon, of prominent persons, including Washington and his wife. Some of these portraits were carried by the painter to England, but two undoubted works of his—profiles of Washington—have long been known here.

In 1882, three pictures, a profile and a full face of Washington and a profile of Lady Washington, were exhibited at the Boston Art Museum as the work of Sharpless.

In 1886 these portraits were again placed on exhibition

in Boston, and it was hoped that the government might purchase them.

Under these circumstances the Massachusetts Historical Society appointed a committee, of which Mr. Francis Parkman, the historian, was chairman, to inquire into the authenticity of the paintings.

The committee reported on the 13th of January, 1887 :

That the profile likeness exhibited bore no resemblance whatever to the two genuine Sharpless profiles of Washington ;

That the full face represented a man in the prime of life, whereas Sharpless never saw Washington till he was an old man, and did not paint his portrait till 1796, only two (?) years before his death ;

That when the portraits were on exhibition in 1882, it was observed that the eyes of Washington were brown, and that those of Lady Washington were blue. When the pictures returned to America in 1886, the eyes of Washington were found to be blue, and those of Lady Washington brown.

The explanations offered on these points by Major Walter, the Englishman who exhibited the portraits, did not satisfy the committee.

The evidence as to the genuineness of these "inestimable treasures" was a pamphlet by Major Walter, containing letters, the originals of which were said to be no longer in existence. The most important of these were : a letter bearing the signature of Washington, extracts from letters ascribed to Sharpless, and a letter signed by Robert Cary, Washington's London agent not long before the Revolution.

Cary's letter was found to bear a startling resemblance

to a well-known passage of a speech delivered in 1814 by Charles Phillips, the Irish orator; while the letter of Washington and the Sharpless extracts displayed a familiarity, little less than miraculous, with Major Walter's own cast of mind and inadmissible English. As with Washington and Sharpless, so with many others—Gallatin, Trumbull, Cadwallader Colden, Washington Irving, Emerson, and Hawthorne. Each of these, individual and recognizable elsewhere, yielded up character and language and intellect at the touch of Major Walter's omnific hand. It overtaxes even the resources of classic Latin to express his merit:

Nil tetigit quod non *majoravit*.

GAZETTEER OF THE BRITISH ISLES.—This Gazetteer, edited by Mr. John Bartholomew, F.R.G.S., and published by Adam and Charles Black, Edinburgh, is a marvel of compactness and thoroughness.

The two questions which first occur to any one who consults a gazetteer for information respecting a place are, as Mr. Bartholomew says: "Where is it?" and "What of it?"; and it would not be easy to name any place in the United Kingdom concerning which this volume is silent.

The wealth of illustration by means of maps is ample.

There are maps and charts giving the Heights of Land and Depths of Sea, the Temperature, Rainfall, River Basins, and Tides; Vital and Industrial Maps, showing the Density of Population, the Birth and Death Rates, the Industries and their Distribution, the Arable and Pasture Lands, etc.; Parliamentary and Railway Maps, besides the General Maps of each kingdom, and one

showing the Light-houses on all the Coasts ; and the appendices contain a great body of valuable statistics.

The typographical execution of the work is worthy of its intrinsic merit.

GEOGRAPHY AT OXFORD.—A Readership in Geography has been endowed by the University of Oxford for the next five years, with an annual stipend of £300 to the Reader. So far as is known, this is the first definite recognition of the study of Geography by a College or University, among the English-speaking peoples ; and it was eminently fit that Oxford should lead the way.

A SITE FOR AN OBSERVATORY.—Prof. Edward C. Pickering, Director of the Harvard College Observatory, calls attention to the will of the late Uriah A. Boyden, by which property, now exceeding two hundred and thirty thousand dollars in value, was left for the purpose of astronomical research "at such an elevation as to be free, so far as practicable, from the impediments to accurate observations which occur in the observatories now existing, owing to atmospheric influences."

The fund has been turned over to Harvard College, and the proposed researches will be made under the general management of the Observatory attached to it, and aided by its means, in addition to the fund itself.

For the new permanent Observatory a very great altitude will be advisable, in a position easy of access, and where the station can be occupied at all seasons of the year. A location in the Southern Hemisphere will be preferable. Southern stars, invisible in Europe and the United States, have been less observed than the northern

stars, and by the aid of a southern station investigations can be extended upon a uniform system to all parts of the sky. Information is asked for regarding suitable localities and should give the following details :

1. Latitude and longitude. Distance and direction from a town or well-known point. Height, and how determined.

2. Peak, pass, or table-land. Character of surface : ledge, broken rock, gravel, or covered with trees, shrubs, or grass. Prevalence of snow in summer, and period during which snow in winter might obstruct access, or occasion inconvenience or damage. Proximity of wood and water.

3. Means of access, distance from and height above nearest railroad station, wagon-road, bridle-road, or foot-path. Time of ascent and descent. Nearest post-office and telegraph-station, and distances from station. Nearest point of road kept open in winter.

4. Observation of rainfall at different seasons. Proportion of sky covered with cloud at different hours and seasons. These observations are desired at sunset, sunrise, and late in the evening. Observations may be made of a distant mountain peak, evening observations being confined to moonlight nights. Observation of barometer and thermometer desired. Information wanted regarding the prevalence of very high winds ; the presence of dust, haze, or smoke from forest fires, rendering distant points invisible ; and all meteorological phenomena affecting the value of the station for astronomical purposes. Duration of rainy or cloudy season, if any ; and regular recurrence of clouds, thunder-storms, or wind at any given hour of the day.

5. Sketches or photographs of the proposed location, and of points on the road ; also of the view.

Correspondence to be addressed to Prof. Pickering, at Cambridge, Mass., U. S. A.

RELIEF OF EMIN PASHA.—Twelve years ago Dr. Schnitzler, an Austrian physician and scientist, entered the Egyptian service as Emin Bey, and was made surgeon-general under Gordon, then Governor of the Egyptian Soudan.

To his extensive scientific acquirements Emin Bey added remarkable gifts as a linguist, and he showed, in his relations with the people, and especially in three delicate and dangerous missions to native chiefs, so much tact and discretion that Gordon appointed him, in 1878, Governor-General of the Egyptian Equatorial Provinces.

These provinces, to which Dr. Felkin generously ascribes an extent little less than that of Europe, were in any case very large. Emin Bey established posts at forty principal points, constructed roads, introduced the regular cultivation of useful plants, maintained peace and order, and began the instruction of the people in the arts of civilization.

Communication with his government was cut off early in 1883 by what English authorities call the rebellion of the Soudan.

Emin Bey had then with him but two European companions, both experienced African travellers, Dr. Junker, a Russian scientist, and Capt. Casati, formerly an officer in the Italian army.

When the English campaign in the Soudan came to a disastrous end, it was supposed that all signs of the Egyptian domination in that remote territory had disappeared; but late in 1886 Dr. Junker suddenly returned to the outer world with the news that Emin Bey and Ca-

sati were shut up, with their faithful negro soldiers, in Wadelai, one of the fortified posts on the Nile, about fifty miles from the northern end of Lake Albert Nyanza. Mahehi, a post on the lake itself, is possibly still held by Emin Bey; and he had on the lake last summer two steamers, besides four iron life-boats, each capable of containing sixty men.

A private expedition was immediately organized in London for his relief. It was aided by a grant of £10,000 from the Egyptian government, which at the same time promoted the much-enduring Austrian to the rank of Pasha.

Mr. Stanley, the most competent of men for the task, left London on the 21st of January for Zanzibar to take charge of the expedition. He engaged in Egypt and in Eastern Africa a large force of guards and porters, besides a body of sixty Soudanese soldiers.

With these he reached Cape Town on the 9th of March, and left the next day for the Congo, where he expected to arrive by the 18th.

From the mouth of the Congo to the Albert Nyanza is not less than 2,400 miles, and of these 900 must be made by land. The daily march in such an unknown country can hardly amount to 10 miles, and it will be wonderful if the expedition comes in sight of the lake before the 1st of August.

Can Emin Pasha hold out till then? That is the question; and there is no one who can answer it.

The situation is so like that of Gordon at Khartoum that men naturally fear the worst. There has been, at least, no delay in the present instance, and Stanley will do every thing that can be done by a leader; but he may arrive too late, though a telegram of March 14th from

Zanzibar reported Emin Pasha well on the 24th of January. He had made an ineffectual effort to reach the coast, and had been forced to return to Wadelai.

NORTH ATLANTIC CURRENTS.—A report presented to the French Academy of Sciences on the 10th of January, 1887, gives the results of the Prince of Monaco's experiments on the Atlantic currents, in the years 1885 and 1886. The experiment of 1885 has already been noticed in the *BULLETIN*. The floats thrown into the sea on that occasion, near the Azores, numbered 169, of which 14 were recovered, showing a drift in a S. E. direction, at the rate of 3.83 miles per 24 hours.

In 1886, 510 floats were sent out much nearer to the French coast.

Nine of these have been found in positions showing also a S. E. drift, with velocities varying from 5.80 to 6.45 miles.

These experiments have not greatly added to our knowledge of ocean currents.

TO THE NORTH POLE BY LAND.—Col. Gilder has given up for the present his attempt to reach the North Pole by way of Hudson Bay. He now intends to take the next Hudson Bay boat, or a whaling-vessel, and to join his companion Griffith at Nottingham Island, and renew his effort.

An expedition very similar to Col. Gilder's has been begun by Mr. Alexander McArthur, who left Winnipeg on the 13th of February to push to the northward along the west coast of Hudson Bay, and through King William Land and Boothia to Grinnell Land. Mr. McArthur proposes to be gone three or four years.

RAINFALL ON THE LAND OF THE GLOBE.—In the *Scottish Geographical Magazine* for February, 1887, Mr. John Murray has a paper on the rainfall of the globe and its relation to rivers. The elaborate tables given by Mr. Murray bring together at a glance the results of an immense amount of work.

He estimates the total rainfall at 29,350 cubic miles, of which 2,243 cubic miles fall on the inland drainage areas, such as the Caspian, the Sahara, and the like. These inland areas occupy 11,486,350 square miles, and correspond in locality very closely with the rainless regions of the earth—those, that is to say, in which the annual rainfall is less than 10 inches. The area of these regions is 12,200,000 square miles. The inland drainage areas, the rainless regions, and the great desert regions largely coincide, and are situated in two belts around the world, one in the Northern Hemisphere, nearly between latitudes 30° and 40°, the other in the Southern Hemisphere, nearly between 20° and 30° of latitude.

The primary cause of the rainless, desert, and inland drainage areas is to be traced to the fact that they are situated where the winds blow from colder to warmer latitudes, and from off land, and not from the ocean.

None of the rain falling on the inland drainage areas ever reaches the sea by means of rivers. There are left, therefore, 44,211,050 square miles of land which drain into the ocean. Of these, 26,400,000 drain into the Atlantic or its tributary basins, and of the 27,110 cubic miles of rain that fall on the land draining into the oceans, 15,788 cubic miles, or more than half, fall on the Atlantic area.

The Pacific drainage area receives 5,007 cubic miles,

and that of the Indian Ocean 4,379 cubic miles, while the rain and snow falling on the Antarctic continent are estimated at 1,688 cubic miles.

The proportion of rainfall on a river basin to the amount of water discharged at its mouth varies according to the geographical position of the river. In European rivers, between a third and a fourth of the rainfall reaches the sea. The Mississippi discharges one fourth of the rain it receives *into the Caribbean Sea*, a performance which displays, on the part of the river or of Mr. Murray, a wholly unexpected contempt for the acquired rights of the Gulf of Mexico.

One half of the rainfall on the basin of the Yukon finds its way to the ocean.

In tropical or sub-tropical rivers the average discharge is about one fifth of the rainfall, though the Nile, it must be noted, delivers only $\frac{1}{37}$ of the amount received.

The figures relating to some of the great river-basins are interesting.

The Amazon, with an area of 2,229,900 square miles, receives 2,833 cubic miles of rain. The Congo comes next with 1,540,800 square miles, and 1,213 cubic miles; then the Nile, with an area of 1,293,050 square miles and a rainfall of 892 cubic miles; then the Mississippi, with 1,285,300 square miles, and 673 cubic miles of rain; and the La Plata, with 994,900 square miles of area, and a rainfall of 904 cubic miles.

The composition of river water has been estimated by Mr. Murray from the analysis of 19 rivers. According to these each cubic mile of river water that reaches the sea carries with it 762,587 tons of matter in solution and suspension. The 6,524 cubic miles carried into the ocean

every year take with them, therefore, no less than 4,974,967,588 tons of solid matter.

THE LONGEST RIVER.—A posthumous paper by Dr. G. A. Von Klöden, published in the *Zeitschrift* of the Berlin *Gesellschaft für Erdkunde*, vol. 20, part vi., gave the length of 376 rivers in different parts of the world, calculated in kilometres. According to this, the longest river was the Nile, with 6,470 kilometres, and the next the Mississippi-Missouri, with 5,882 kilometres.

The Russian general, Von Tillo, revising these calculations, gives the first place to the Mississippi-Missouri, with 6,750 kilometres, and the second to the Nile, with the 6,470 kilometres assigned it by Von Klöden.

The two authorities agree as to some other great rivers. To the Ta-Kiang, or Yang-Tse-Kiang, they give 5,083 kilometres, to the Amazon 4,929, to the Yenisei-Selenga 4,750, to the Congo 4,640, to the Mackenzie 4,615, and to the Amoor 4,378.

After these come, according to Von Klöden, the Cambodia with 4,240 kilometres, the Ob with 4,229, the Hoang-Ho with 4,192, and the Lena with 4,036.

The difficulties in the way of exact measurement are so many that there must always remain some uncertainty as to the relative figures.

THE NAME OF CELEBES.—According to the *Bulletin* of the Lille Geographical Society, Mr. Van Hoëvell, Dutch Assistant-Resident at Gorontalo, says that the European navigators gave to Celebes the name it now bears from the words *Sooloo besi*, in order to distinguish it from the other Sooloo islands. The word *besi* (written *bási* in

Craufurd's dictionary) means *iron*, and the western coast of Celebes is rich in this metal.

The descent from *Sooloo besi* to the present form is easy enough, and the etymology so far recommends itself, though the process by which it is reached is depressingly like that which has given us, among other wild guesses, the derivation of Canada from *Acá nada*, and California from *Calida fornax*.

THE RIVERS OF EASTERN EUROPE.—M. Venukoff, in a recent study on the Russian rivers, shows that the problem of maintaining them in a navigable condition is very similar to the one presented by the rivers of the United States. The two principal obstacles to be met in both cases are, the closing of the rivers by ice in the winter, and the breaking up in the spring.

In Western Europe, the Rhine, the Thames, the Seine, or the Loire, may be covered with ice once in ten or fifteen years, for five or ten days; very rarely, for three weeks.

In Russia, on the contrary, all the rivers, excepting those of Transcaucasia, are closed every year for several weeks or months. M. Venukoff gives from M. Rykatcheff's work a table showing the number of days during which navigation remains open on the following rivers:

Dwina, at Archangel . . .	182 days.
“ at Veliki-Ustiug . . .	202 “
Neva, at St. Petersburg . . .	222 “
Volkhov, at Grusino . . .	221 “
Düna, at Dunaburg . . .	243 “
Niemen, at Grodno . . .	256 “

Bug, at Brest-Litovsk	254 days.
Dnieper, at Kiev	270 "
" at Kremenschug	275 "
" at Kherson	282 "

Kherson, it must be remarked, is in the latitude of Nantes, where the Loire never freezes, and Kiev is almost due east from Coblentz, where the Rhine is sometimes, though rarely, frozen for a very few days.

Comparisons between the rivers of Western and Eastern Russia show that the time of open navigation diminishes regularly towards the east, all other things being equal.

The force of the current is always to be taken into account since very rapid rivers often remain open even in high northern latitudes.

The melting of the ice in the spring is accompanied, in Russia, with peculiar dangers. Generally, the breaking up does not occur at the same time on the whole course of the river, especially when this flows with the meridian. The Volga, for instance, is free from ice at Astrakhan about the 16th of March, but remains bound till the 26th of April at Gorodetz, 2,300 kilometres up stream; so that the melting lasts through forty days. Moreover, the snows are so abundant that the thaw is always accompanied with tremendous freshets; and these shorten still more the period of navigation, especially on the two principal rivers of European Russia, the Volga and the Dnieper.

The freshets in the basin of the Volga are the most formidable, and observations show that at Samara the spring flood rises to twelve metres above the level of the frozen river, and that on the Oka, a branch of the

Volga, the difference between the winter and the spring level at Kaluga is but a fraction less than fourteen metres. In the west the freshets are comparatively mild, the Niemen and the Vistula never rising quite five metres above their ordinary level. In the west, it is observed, the melting is continuous even during the winter, while in the east it comes on all at once after a long period of intense cold.

OBITUARY.—A communication from the Geographical Society of Berne brings intelligence of the death, on the 22d of February, 1887, of Gustav Reymond-Le Brun, Chief Secretary of the Society and Editor of its Yearly Review. Herr Reymond-Le Brun was an indefatigable and conscientious worker, and his loss is deeply felt by his associates.

Dr. Gustav Kirchenpauer, presiding Burgomaster of Hamburg, and first President of the Geographical Society of that city, died suddenly in the night of the 3d-4th of March, 1887.

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GRAND CAÑON OF THE COLORADO,
Looking east from the foot of the Torowcap Valley. Depth at this point, 4,500 feet.